Open Geospatial Consortium

OGC TimeseriesML 1.3 – XML Encoding of the Timeseries Profile of Observations and Measurements

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Contents

i.   Abstract

TimeseriesML 1.3 defines an XML encoding that implements the OGC Timeseries Profile of Observations and Measurements, with the intent of allowing the exchange of such data sets across information systems. Through the use of existing OGC standards, it aims at being an interoperable exchange format that may be re-used to address a range of data exchange requirements.

ii.   Keywords

The following are keywords to be used by search engines and document catalogues.

Timeseries, Observations, Exchange, Interoperability, OGC, TimeseriesML, XML, GML

iii.   Preface

This standard is an XML implementation of the conceptual model defined in OGC Timeseries Profile of Observations and Measurements. This standard has been developed from work initially undertaken within OGC WaterML 2.0: Part 1 – Timeseries.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium shall not be held responsible for identifying any or all such patent rights.

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

iv.   Security Considerations

No security considerations have been made for this Standard

v.   Submitting organizations

The following organizations submitted this Document to the Open Geospatial Consortium (OGC):

- Australian Bureau of Meteorology
- Met Office
- Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Landcare Research
- Météo-France
- KISTERS AG
- Environment Canada
- US National Weather Service

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1. Scope

This document is an OGC® Implementation Standard for the representation of the Timeseries Profile of Observations and Measurements as XML. TimeseriesML 1.3 is implemented as an application schema of the Geography Markup Language version 3.3, making use of the OGC Observations & Measurements standards. TimeseriesML 1.3 is designed as an extensible schema to allow encoding of data to be used in a variety of exchange scenarios. Example areas of usage are: cross-border exchange of observational data; release of data for public dissemination; enhancing disaster management through data exchange; and exchange in support of national reporting. The core aspect of the Timeseries Profile of Observations and Measurements is the correct, precise description of timeseries. This document defines an implementation of this profile.

2. Conformance

This standard defines an XML encoding standard for the OGC Timeseries Profile of Observations and Measurements.

Conformance with this standard shall be checked using all the relevant tests specified in Annex A (normative) of this document. The framework, concepts, and methodology for testing, and the criteria to be achieved to claim conformance are specified in the OGC Compliance Testing Policies and Procedures and the OGC Compliance Testing web site[1.]

In order to conform to this OGC™ interface standard, a software implementation shall choose to implement:

1. Any one of the conformance classes specified in Annex A (normative).

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

3. References

The following normative documents contain provisions that, 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.

OGC: OGC 15-043 – Timeseries Profile of Observations and Measurements, 2016

OGC: OGC 08-131r3 – The Specification Model – A Standard for Modular Specification, 2009

ISO: ISO 19103:2005 – Conceptual Schema Language, 2005

ISO: ISO 19108:2002 – Geographic information – Temporal schema, 2002

ISO: ISO 19109:2005 – Geographic information – Rules for application schema, 2005

ISO: ISO 8601- Data elements and interchange formats – Information interchange – Representation of dates and times, 2019

OGC: OGC Abstract Specification Topic 20 – Observations and Measurements (OGC Document 10-004r3, aka ISO 19156:2011), 2011

OGC: OGC Abstract Specification Topic 2 – Spatial Referencing by Coordinates (aka ISO 19111:2007), 2007

OGC: OGC Abstract Specification Topic 6 – Schema for Coverage geometry and functions (OGC Document 07-011, aka ISO 19123:2005), 2005

OGC: OGC Abstract Specification Topic 11 – Geographic information — Metadata (aka ISO 19115:2003), 2003

OGC: OGC 07-036 Geography Markup Language (aka ISO 19136:2007), 2007

OGC: OGC WaterML2.0 part 1 – timeseries. OGC 10-126r4, 2014

OGC: OGC Observations and Measurements v2.0 OGC Document 10-004r1 (also published as ISO/DIS 19156:2010, Geographic information— Observations and Measurements), 2010

OGC: OGC SWE Common Data Model Encoding Standard v2.0 OGC Document 08-094r1, 2011

UCUM: Unified Code for Units of Measure (UCUM) – Version 1.8, 2009

Unified Modeling Language (UML). Version 2.3, 2010

Extensible Markup Language (XML) – Version 1.0 (Fourth Edition), 2006

XML Schema – Version 1.0 (Second Edition), 2004

4. Terms and Definitions

This document used the terms defined in Policy Directive 49[1], which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word "shall" (not "must") is the verb form used to indicate a requirement to be strictly followed to conform to this Standard and OGC documents do not use the equivalent phrases in the ISO/IEC Directives, Part 2.

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

4.1
Coverage
Feature that acts as a function to return values from its range for any direct position within its spatial, temporal or spatiotemporal domain

[ISO 19123:2005, definition 4.17]

4.2
Domain Feature
Feature of a type defined within a particular application domain

[ISO 19156, definition 4.4]

4.3
Feature
Abstraction of real-world phenomena

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[1] https://portal.ogc.org/public_ogc/directives/directives.php

[ISO 19101:2002, definition 4.11]

4.4
Observation
Act of observing a property

[ISO 19156, definition 4.10]

4.5
Observation Procedure
Method, algorithm or instrument, or system of these which may be used in making an observation

[ISO19156, definition 4.11]

4.6
Property <General Feature Model>
Facet or attribute of an object referenced by a name

EXAMPLE: Abby's car has the colour red where "colour red" is a property of the car instance

4.7
Sampling Feature
Feature, such as a station, transect, section or specimen, which is involved in making observations concerning a domain feature

[ISO19156, definition 4.16]

4.8
Sensor
Type of observation procedure that provides the estimated value of an observed property at its output

Note: A sensor uses a combination of physical, chemical or biological means in order to estimate the underlying observed property. At the end of the measuring chain electronic devices often produce signals to be processed

[OGC SWE Common 2.0, definition 4.5.]

4.9
Timeseries
A sequence of data values which are ordered in time. The sequence typically records (or predicts) the value of a property of a feature over a time interval, with interim values at times within the interval. These times are monotonic and are often, but not always, at regular intervals (e.g., an hourly timeseries).

5. Conventions

5.1 Abbreviated Terms

In this document the following abbreviations and acronyms are used or introduced:

ISO   International Organization for Standardization

O&M   Observations and Measurements

OGC   Open Geospatial Consortium

SensorML   Sensor Model Language

SWE   Sensor Web Enablement

TSML   TimeseriesML

TVP   Time-Value Pair

UML   Unified Modeling Language

UTC   Coordinated Universal Time

XML   Extensible Markup Language

5.2 UML Notation

The diagrams that appear in this standard are presented using the Unified Modeling Language (UML) static structure diagram.

Note: Within the context of this profile, the following color scheme is used to identify the package in which the class exists. This is just for informative purposes.

Blue: Defined within the Timeseries Profile of O&M (conceptual model)

Yellow: Defined within this standard (XML implementation model)

Green: ISO19156 – Observations & Measurements

Red: Other (ISO or GML)

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5.3 Finding Requirements and Recommendations

This standard is identified as http://www.opengis.net/spec/timeseriesml/1.3. For clarity, each normative statement in this standard is in one and only one place and defined within a requirements class table and identified with a URI, whose root is the specification URI. In this standard, all requirements are associated to tests in the abstract test suite in Annex A using the URL of the requirement as the reference identifier.

Requirements classes are separated into their own clauses and named and specified according to inheritance (direct dependencies). The Conformance test classes in the test suite are similarly named to establish an explicit and mnemonic link between requirements classes and conformance test classes.

6. XML Implementation (normative)

In addition to the UML conceptual model this standard defines a GML XML Schema implementation that is compliant to the UML conceptual model. The XML Schemas for this implementation are published at:

http://schemas.opengis.net/tsml/1.3/

Schematron patterns are implemented for some requirements where appropriate and are published at the same location.

6.1 XML encoding principles

The following principles apply to data encoded according to the TimeseriesML 1.3 XML schema.

6.1.1 Conformance to GML 3.3 encoding rules for codelists

This XML Schema implementation imports the OGC GML 3.2.1 schemas. However codelists are implemented according to the clarified rules for codelists in the OGC GML 3.3 specification. Namely that items in codelists are referred to using gml:ReferenceType and not encoded with gml:CodeType.

None of the GML 3.3 schema types are used in this implementation and therefore only GML 3.2.1 schemas are imported by the TimeseriesML 1.3 XML schemas. This is consistent with the note in the GML 3.3 specification which reads: *A GML application schema conforming to this standard will import the GML 3.2 schema plus zero or more additional GML 3.3 schemas as needed.*

6.1.2 Extends the OGC Implementation Schema for Coverages

The TimeseriesML schema supports both an interleaved time-value pair encoding and a domain, range encoding. The domain, range encoding inherits from the coverage schema defined in the OGC Implementation Schema for Coverages (09-146r2). The interleaved timeseries encoding is a representation of a special case of the CV_DiscreteCoverage class from OGC Abstract Specification Topic 6, in which each GeometryValuePair has a

'geometry' which is a timestamp, and a 'value' which is a measure or other simple datatype. The OGC CIS v1.1 specification provides alternative representations of coverages, including an option for interleaving coverages, which can be useful for timeseries of more complex values.

6.1.3 Virtual typing

In accordance with OMXML, the specialization of the OM_Observation result type is provided through schematron restriction. The om:type element may be used to specify the type of OM_Observation that is being encoded. This shall be done using the OGC Name URI for the corresponding type from the following table.

Table 1 - O&M URIs for observation specializations

TimeseriesML 1.3	OGC Name	Content of om:result in TimeseriesML 1.2 XML[1]
MeasurementTimeseriesTVPObservation	http://www.opengis.net/def/observationType/timeseriesML/1.3/MeasurementTimeseriesTVPObservation	type='tsml:Timeseries' result.value='tsml:MeasurementTVP'
CategoricalTimeseriesTVPObservation	http://www.opengis.net/def/observationType/timeseriesML/1.3/CategoricalTimeseriesTVPObservation	type='tsml:Timeseries' result.value='tsml:CategoricalTVP'
MeasurementTimeseriesDomainRangeObservation	http://www.opengis.net/def/observationType/timeseriesML/1.3/MeasurementTimeseriesDomainRangeObservation	type='tsml:TimeseriesDomainRange'
CategoricalTimeseriesDomainRangeObservation	http://www.opengis.net/def/observationType/timeseriesML/1.3/CategoricalTimeseriesDomainRangeObservation	type='tsml:TimeseriesDomainRange'

Likewise, a *tsml:type* property is present on the TimeseriesDomainRange type to enable a soft-typing approach to this class. The values for this property should be taken from Table 2.

Table 2 - TimeseriesML URIs for TimeseriesDomainRange specialisations

Timeseries Profile of O&M Type	tsml:type value in tsml:TimeseriesDomainRange
MeasurementTimeseriesDomainRangeTimeseries	http://www.opengis.net/def/timeseriesType/timeseriesML/1.3/Tim e/MeasurementTimeseriesDomainRange
CategoricalTimeseriesDomainRangeTimeseries	http://www.opengis.net/def/timeseriesType/timeseriesML/1.3/Tim e/CategoricalTimeseriesDomainRange

6.1.4 Efficiency of encoding

This XML Schema implementation takes the approach that, where conceptual classes can be combined without loss of clarity, they are. For example, the same metadata classes are used for both Categorical and Measurement timeseries. This is to avoid a proliferation of similar classes in the XML encoding.

The following table outlines the mapping between the conceptual model and the XML Schema implementation.

Table 3 - Mapping of Timeseries Profile of Observations and Measurments toTimeseriesML 1.3 XML Schema types

Timeseries Profile of Observations and Measurements	TimeseriesML 1.3 XML
Collection	tsml:Collection
DocumentMetadata	tsml:DocumentMetadata
CategoricalTimeseriesTVPObservation	om:OM_Observation*
MeasurementTimeseriesTVPObservation	
CategoricalTimeseriesDomainRangeObservation	
MeasurementTimeseriesDomainRangeObservation	
TimeseriesTVP	tsml:TimeseriesTVP
MeasurementTimeseriesTVP	
CategoricalTimeseriesTVP	
TimeseriesDomainRange	tsml:TimeseriesDomainRange
MeasurementTimeseriesDomainRange	
CategoricalTimeseriesDomainRange	
PointMetadata	tsml:PointMetadata
MeasurementPointMetadata	

CategoricalPointMetadata	
TimeValuePair	tsml:TimeValuePair (abstract)
MeasureTimeValuePair	tsml:MeasurementTVP
CategoricalTimeValuePair	tsml:CategoricalTVP
ObservationProcess	tsml:ObservationProcess
MonitoringFeature	tsml:MonitoringFeature
* The specialization of OM_Observation is provided through Schematron rather than a specialized XML type.	

6.1.5 Abstract requirements and conformances classes

As noted in the OGC Modular Specification section 6.2, the tests for abstract conformance classes may need to be described in the subclass classes if the base requirements classes are ambiguous for the abstract class. This is the case for the two styles of timeseries conformance classes, domain-range and interleaved (time-value pair). Some requirements for these classes are re-specified in more concrete terms to allow more explicit testing.

6.2 XML Examples

XML examples are published alongside the XML schemas at http://schemas.opengis.net/tsml/1.3/. In all examples, the following namespaces are used:

Table 4 - XML Example Code Namespaces

Identifier	Namespace URL
xsi	http://www.w3.org/2001/XMLSchema-instance
Gml	http://www.opengis.net/gml/3.2
Om	http://www.opengis.net/om/2.0
xlink	http://www.w3.org/1999/xlink
tsml	http://www.opengis.net/timeseriesml/1.0
gmd	http://www.isotc211.org/2005/gmd
gco	http://www.isotc211.org/2005/gco
sam	http://www.opengis.net/sampling/2.0
sams	http://www.opengis.net/samplingSpatial/2.0

6.3 Requirements Class: XML Rules

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules	
Name	XML Rules
Dependency	http://www.w3.org/TR/xmlschema-2
Dependency	http://standards.iso.org/iso/8601/2004/4
Dependency	http://www.opengis.net/doc/IS/GML/3.2#clause-2.4
Dependency	http://www.opengis.net/spec/GML/3.3/req/definitions
Dependency	http://www.opengis.net/spec/SWE/2.0/req/xsd-simple-components
Requirement	/req/xsd-xml-rules/iso8601-time All date-time elements shall be encoded using ISO8601 extended time format.
Requirement	/req/xsd-xml-rules/time-zone The value of each time element (defined in the TimeValuePairType 'time' element) shall include a time zone definition using a signed 4-digit character or a 'Z' to represent Zulu or Greenwich Mean Time (GMT). This is defined by the following regular expression: (Z|[+-]HH:MM)
Requirement	/req/xsd-xml-rules/unit-of-measure All units of measure shall use the appropriate code from the The Unified Code for Units of Measure (UCUM) code system. The unit of measure shall be identified by encoding the UCUM code[1] in the 'code' attribute of the tsml:uom element. [1] The UCUM base codes are available in XML form here: http://unitsofmeasure.org/ucum-essence.xml.
Requirement	/req/xsd-xml-rules/swe-types When using the SWE Common types, the following elements shall not be used: swe:quality (*AbstractSimpleComponentType)*, swe:nilValues (*AbstractSimpleComponentType)*, swe:constraint (*QuantityType*, *QuantityRangeType*, *CategoryType*). The attributes '*optional'* and '*updatable'* from the base type '*AbstractDataComponent'* shall also not be used.

Requirement	/rec/xsd-xml-rules/xlink-title
	If an xlink:href is used to reference a controlled vocabulary item, the element should encode the xlink:title attribute with a text description of the referenced item.
Requirement	/rec/xsd-xml-rules/vocabulary-references
	When specifying references to vocabulary (code) items using an xlink:href, a resolvable HTTP URL should be used which, when resolved, should provide suitable description of the concept being referenced.
Requirement	/rec/xsd-xml-rules/xlink-valid-local-reference
	If an xlink:href is a local reference then the referenced element must exist.

6.3.1 Requirements class overview

This requirements class contains a set of general rules applicable to the XML encoding.

6.4 *Requirements Class*: Timeseries Observation

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-timeseries-observation	
Name	Timeseries Observation
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-domain-range-timeseries-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-categorical-domain-range-timeseries-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-measurement-domain-range-timeseries-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-tvp-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-categorical-timeseries-tvp-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-measurement-timeseries-tvp-observation

Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules
Requirement	/req/xsd-timeseries-observation/procedure The xml element om:procedure shall contain an element which is a subtype of OM_Process, such as tsml:ObservationProcess element, or a subtype of SWE AbstractProcess or a reference to an external definition of the process using the xlink:href attribute.
Requirement	/req/xsd-timeseries-observation/phenomenonTime The om:phenomenonTime element shall contain a gml:TimePeriod element that represents the temporal extent of the timeseries result of the observation.

6.4.1 Requirements class overview

This requirements class restricts the content model for the XML element OM_Observation relating specifically to timeseries observations. The requirements classes that depend on this class describe specific result types of time series. The restrictions rules for OM_Observation are captured in the '*xsd-timeseries-observation.sch*' Schematron file.

6.5 *Requirements Class*: Timeseries (TVP) Observation

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-timeseries-tvp-observation	
Name	Timeseries (TVP) Observation
Requirement	/req/xsd-timeseries-tvp-observation/result The xml element om:result shall contain a concrete subelement in the substitution group tsml:TimeseriesTVP.

6.5.1 Requirements class overview

This requirements class captures the core type of timeseries observation – one with a result of an interleaved time-value pair timeseries. This restriction is defined in the '*xsd-timeseries-tvp-observation.sch*' Schematron file.

6.6 *Requirements Class*: Categorical Timeseries (TVP) Observation

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-categorical-timeseries-tvp-observation	
Name	Categorical Timeseries (TVP) Observation

Requirement	/req/xsd-categorical-timeseries-tvp-observation/result The xml element om:result shall have a value that matches the content model defined by tsml:CategoricalTVP.

6.6.1 Requirements class overview

This requirements class restricts the type of timeseries observation to one with a result of an interleaved time-value pair timeseries where each value is a Category. This restriction is defined in the '*xsd-categorical-timeseries-tvp-observation.sch*' Schematron file.

6.7 *Requirements Class*: Measurement Timeseries (TVP) Observation

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-measurement-timeseries-tvp-observation	
Name	Measurement Timeseries (TVP) Observation
Requirement	/req/xsd-measurement-timeseries-tvp-observation/result The xml element om:result shall have a value that matches the content model defined by tsml:MeasurementTVP.

6.7.1 Requirements class overview

This requirements class restricts the type of timeseries observation to one with a result of an interleaved time-value pair timeseries where each value is a Measure. This restriction is defined in the '*xsd-measurement-timeseries-tvp-observation.sch*' Schematron file.

6.8 *Requirements Class*: Timeseries (Domain Range) Observation

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-timeseries-domain-range-observation	
Name	Timeseries (Domain Range) Observation
Requirement	/req/xsd-timeseries-domain-range-observation/result The xml element om:result shall contain a concrete subelement in the substitution group tsml:TimeseriesDomainRange.

6.8.1 Requirements class overview

This requirements class captures the domain range type of timeseries observation. This restriction is defined in the '*xsd-timeseries-domain-range-observation.sch*' Schematron file.

6.9 *Requirements Class*: Categorical Timeseries (Domain Range) Observation

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-categorical-timeseries-domain-range-observation	
Name	Categorical Timeseries (Domain Range) Observation
Requirement	/req/xsd-categorical-timeseries-domain-range-observation/result The xml element om:result shall contain a concrete subelement in the substitution group tsml:TimeseriesDomainRange with range element values of type Category contained in a (GML) ValueArray

6.9.1 Requirements class overview

This requirements class captures the categorical domain range type of timeseries observation.

6.10 *Requirements Class*: Measurement Timeseries (Domain Range) Observation

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-measurement-timeseries-domain-range-observation	
Name	Measurement Timeseries (Domain Range) Observation
Requirement	/req/xsd-measurement-timeseries-domain-range-observation/result The xml element om:result shall contain a concrete subelement in the substitution group tsml:TimeseriesDomainRange with a rangeset of type QuantityList.

6.10.1 Requirements class overview

This requirements class captures the measurement domain range type of timeseries observation.

6.11 *Requirements Class*: Timeseries encoded as Time-Value Pairs

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-timeseries-tvp	
Name	Timeseries encoded as Time-Value Pairs
Target Type	XML encoding
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-core
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-tvp

Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-categorical-timeseries-tvp
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-measurement-timeseries-tvp
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules
Requirement	/req/xsd-timeseries-tvp/valid The content model of this XML element shall have a value that matches the content model defined by tsml:TimeseriesTVP.
Requirement	/req/xsd-timeseries-tvp/time-increasing The domain elements (implemented as the tsml:point element) shall be ordered in increasing time.
Requirement	/req/xsd-timeseries-tvp/record-homogenous The type of the tsml:value element (range) shall be the same for each point in the timeseries, with the exception null values which may be used on any value.
Requirement	/req/xsd-timeseries-tvp/domain-time The domain of the timeseries coverage shall consist only of a temporal component.
Requirement	/req/xsd-timeseries-tvp/default-point-metadata If the element defaultPointMetadata is present, the specified metadata elements apply as default values to all subsequent point elements encoded in the timeseries. If a metadata element is specified for a point then it overrides the default value. For elements with multiple cardinality (e.g., qualifiers), defaults shall be overridden if a single element is defined in the metadata.
Requirement	/req/xsd-timeseries-tvp/equidistant-encoding If the *baseTime* and *spacing* elements are defined, the *time* element shall not be encoded. The time instants shall be calculated according to the following: time (n) = baseTime + (n * spacing) n = zero-based point index. e.g., baseTime= 2011-01-01T00:00:00, spacing=P15M points: [0] - 2011-01-01T00:00:00 [1] - 2011-01-01T00:15:00 [2] - 2011-01-01T00:30:00 [3] - 2011-01-01T00:45:00 [4] - 2011-01-01T01:00:00

Requirement	/req/xsd-timeseries-tvp/time-mandatory If the baseTime and spacing elements are not present, the time element shall be encoded.
Requirement	/req/xsd-timeseries-tvp/null-value To indicate a value is null, the xsi:nil attribute shall be set to 'true'.
Requirement	/req/xsd-timeseries-tvp/null-point-reason If a point is specified as null, a nilReason or censoredReason shall be provided.
Requirement	/rec/xsd-timeseries-tvp/nil-reason-vocab When specifying a null point reason (nilReason), one of the following URLs should be used: Inapplicable (http://www.opengis.net/def/nil/OGC/0/inapplicable) Missing (http://www.opengis.net/def/nil/OGC/0/missing) Template (http://www.opengis.net/def/nil/OGC/0/template) - value will be available at later date. Unknown (http://www.opengis.net/def/nil/OGC/0/unknown) Withheld (http://www.opengis.net/def/nil/OGC/0/withheld.html)

6.11.1 Requirements class overview

The Time-Value Pair (TVP) Encoding schema contains types suitable for encoding TimeSeries (both Measurement and Categorical) in a sequence of time-value pairs.

Note that this time-value pair encoding of timeseries encoding takes the name 'TimeseriesTVP'.

The domain range encoding equivalent takes the name TimeseriesDomainRange.
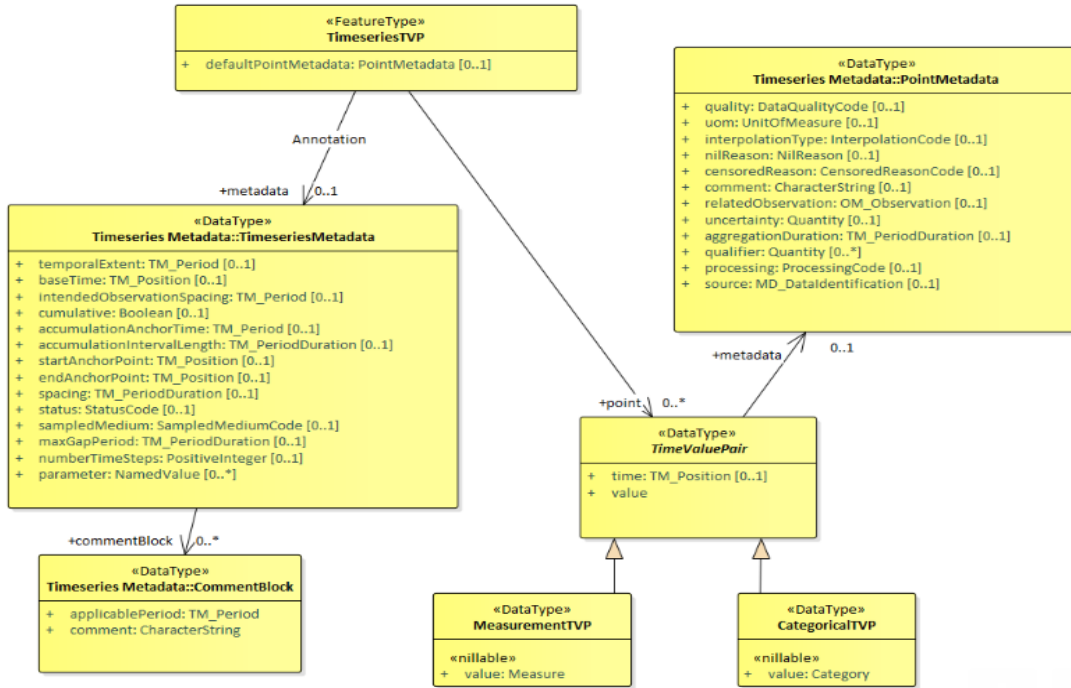
Figure 1 - TVPEncoding

The complete TVP encoding of timeseries, including associated metadata classes is shown in the figure above.

6.11.2 CategoricalTVP properties

CategoricalTVP is the encoding for time,value pairs where the value is a category.

Property	Definition	Data types and values	Multiplicity
value	The categorical value of the data point (e.g., 'High')	Category	1..1

6.11.3 Measure properties

Measure is a measure implementation with an optional unit of measure (so that the unit of measure can be set to a default for the whole timeseries rather than repeating the unit for each data value).

Property	Definition	Data types and values	Multiplicity
uom	Unit of measure	Uom	0..1

6.11.4 MeasurementTVP properties

MeasurementTVP is the encoding for time,value pairs where the value is a measure.

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Property	Definition	Data types and values	Multiplicity
Value	The measurement value for this data point (e.g., 5.3m)	Measure	1..1

6.11.5 TimeseriesTVP properties

The core class for the timeseries time-value pair encoding.

Property	Definition	Data types and values	Multiplicity
point	Data points (time-value pairs) for the timeseries.	TimeValuePair	0..*
metadata	Metadata about the timeseries	TimeseriesMetadata	0..1
defaultPointMetadata	Default metadata for each point in the timeseries (can be over-ridden on a per-point basis).	PointMetadata	0..1

6.11.6 TimeValuePair properties

A base class for different time-value pair implementations.

Property	Definition	Data types and values	Multiplicity
metadata	Point metadata for this point (over-rides any default point metadata for the timeseries).	PointMetadata	0..1
time	Time component of the time-value pair. (A point on the timeseries).	TM_Position	0..1
value	Value component of the time-value pair (a value result such as a measurement).		1..1

6.12 *Requirements Class*: Categorical (TVP) Timeseries

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-categorical-timeseries-tvp	
Name	Categorical (TVP) Timeseries
Requirement	/req/xsd-categorical-timeseries-tvp/value-category The type of the tsml:value XML element shall be a swe:Category.

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6.12.1 Requirements class overview

This requirements class restricts the value type of each time-value pair to be a Category.

6.13 *Requirements Class*: Measurement (TVP) Timeseries

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-measurement-timeseries-tvp	
Name	Measurement (TVP) Timeseries
Requirement	/req/xsd-measurement-timeseries-tvp/value-measure The type of the tsml:value element shall be a tsml:Measure.

6.13.1 Requirements class overview

This requirements class restricts the value type of each time-value pair to be a Measure.

6.14 *Requirements Class*: Timeseries encoded as Domain Range

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-timeseries-dr	
Name	Timeseries encoded as Domain Range
Target Type	XML encoding
Dependency	http://www.opengis.net/doc/GML/GMLCOV/1.0.1#clause-6
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-core
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-domain-range
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-measurement-timeseries-domain-range
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-categorical-timeseries-domain-range
Requirement	/req/xsd-timeseries-dr/valid The content model of this XML element shall have a value that matches the content model defined by tsml:TimeseriesDomainRange.

Requirement	/req/xsd-timeseries-dr/time-increasing The domain elements shall be ordered in increasing time.
Requirement	/req/xsd-timeseries-dr/record-homogenous The type of each range element shall be the same for each point in the timeseries, with the exception null values which may be used on any value.
Requirement	/req/xsd-timeseries-dr/domain-time The domain of the timeseries coverage shall consist only of a temporal component.
Requirement	/req/xsd-timeseries-dr/default-point-metadata If the element defaultPointMetadata is present, the specified metadata elements apply as default values to all subsequent point elements encoded in the timeseries. If a metadata element is specified for a point then it overrides the default value. For elements with multiple cardinality (e.g., qualifiers), defaults shall be overridden if a single element is defined in the metadata.

6.14.1 Requirements class overview

The Domain Range Encoding schema contains types suitable for encoding TimeSeries (both Measurement and Categorical) in a domain (times), range (values) block. This schema extends the OGC GMLCov schema.
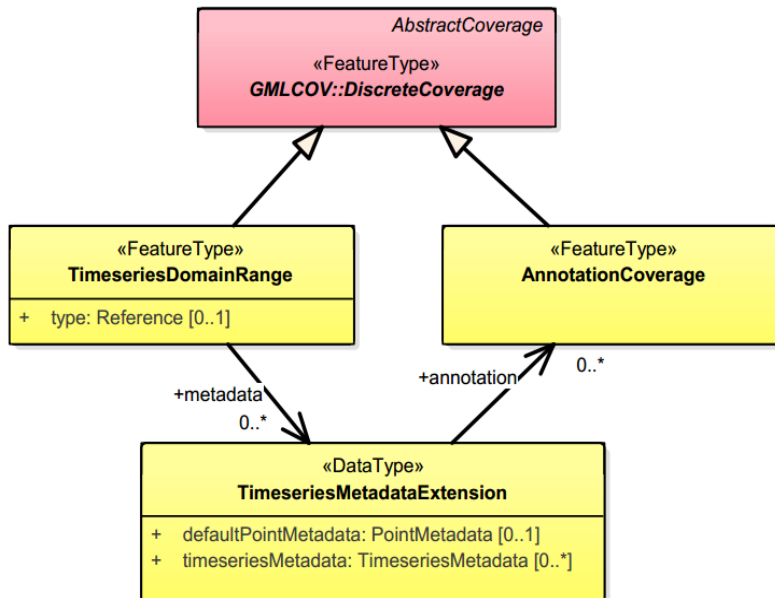
Figure 2 - XML Schema Encoding of Timeseries Domain Range

The TimeseriesDomainRange encoding extends the OGC Implementation Model for Coverages by adding bespoke metadata and annotation elements.
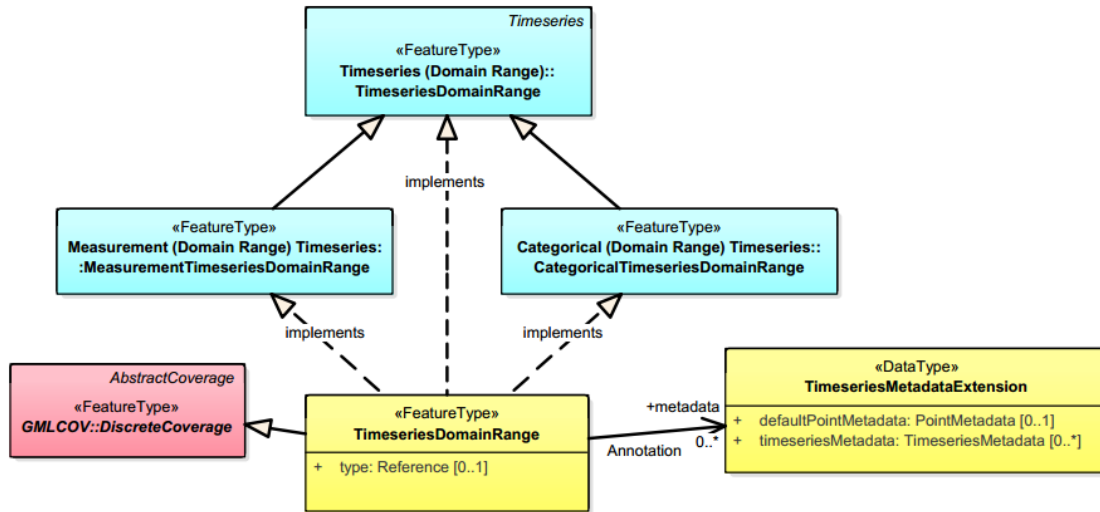
Figure 3 - TimeSeries (Domain Range) Schema

The class TimeseriesDomainRange is used for all domain range encodings. It extends the GMLCov DiscreteCoverage with a timeseries metadata extension.

6.14.2 TimeseriesMetadataExtension properties

TimeseriesMetadataExtension enables use of TimeseriesML metadata classes in GMLCov XML schema. The associated XML examples demonstrate how this is applied in practice.

Property	Definition	Data types and values	Multiplicity
Annotation	An annotation coverage corresponding to points on the timeseries.	AnnotationCoverage	0..*
defaultPointMetadata	Default metadata for each point in the timeseries.	PointMetadata	0..1
timeseriesMetadata	Metadata applicable to the whole timeseries or individual regularly spaced segments of an irregularly spaced whole timeseries.	TimeseriesMetadata	0..*

6.14.3 AnnotationCoverage properties

An annotation coverage can be used to apply metadata to individual points in the timeseries.

Informative note: In the XML Schema the AnnotationCoverage is a specialisation of the gmlcov:AbstractDiscreteGoverage XML Schema type. This standard is not otherwise prescriptive about the content of the AnnotationCoverage beyond that specified in the

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OGC Coverages Implementation Model but it could be used to provide a value array or list of comments or other values as in the two examples below.

```
<tsml:AnnotationCoverage gml:id="quality_cov">
    <gml:domainSet
    xlink:href="#temporal_domain"/>
    <gml:rangeSet>
        <gml:CategoryList
        codeSpace="http://opengis.net/def/waterml/2.0/quali

    ty/">good bad good missing good bad</gml:CategoryList>
    </gml:rangeSet>

    <gmlcov:rangeType/>
</tsml:AnnotationCoverage>


<tsml:AnnotationCoverage gml:id="comment_cov">
    <gml:domainSet
    xlink:href="#temporal_domain"/>
    <gml:rangeSet>
        <gml:ValueArray gml:id="comment_array">
            <gml:valueComponents>

                <gml:Category>This is a free text
                comment</gml:Category> <gml:Category
                xsi:nil="true"/> <gml:Category>Example
                comment</gml:Category> <gml:Category>Another
                one</gml:Category> <gml:Category>Has to be one for
                each point</gml:Category>

            </gml:valueComponents>
        </gml:ValueArray>
    </gml:rangeSet>
    <gmlcov:rangeType/>
</tsml:AnnotationCoverage>
```

6.14.4 TimeseriesDomainRange properties

The TimeseriesDomainRange element extends the OGC coverage model with metadata extensions for timeseries data. The metadata classes are the same as for the time-value pair encoding.

Property	Definition	Data types and values	Multiplicity
metadata	Metadata extension to accommodate TimeseriesML 1.3 metadata classes.	TimeseriesMetadataExtension	0..*

	If present, the sub-element 'type' shall indicate the class of timeseries. A register of type identifiers corresponding with the timeseries types in TimeseriesML 1.3, is provided by OGC at http://www.opengis.net/def/timeseriesType/timeseriesML/1.3		
type		Reference	0..1

6.15 Requirements Class: Collection

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-collection	
Name	Collection
Target Type	XML encoding
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-collection
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-sampling-feature-collections
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules
Requirement	/req/xsd-collection/valid The content model of this element shall have a value that matches the content model defined by tsml:Collection.
Requirement	/req/xsd-collection/sampling-feature-single Single sampling features shall be described using SF_SpatialSamplingFeature or a derivative thereof.
Requirement	/req/xsd-collection/sampling-feature-group Groups of sampling points shall be described using SF_SamplingFeatureCollection feature type from ISO19156.

6.15.1 Requirements class overview

The Collection schema contains a collection element as well as other document specific types.
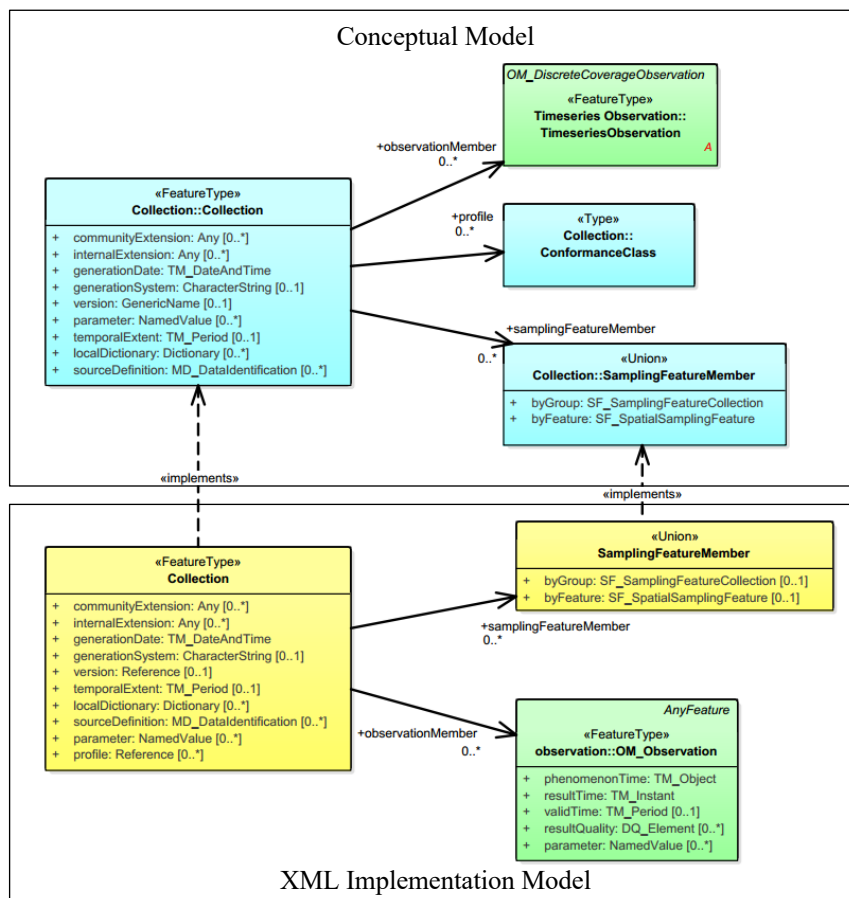
Figure 4 - XML Implementation of Collection and associated classes

The XML Schema implementation of Collection maps closely to the conceptual model. The key implementation points to note are that all observationMembers are implemented by OM_Observation, and that ConformanceClass is implemented as a reference (xlink:href) from DocumentMetadata.

6.15.1.1 Collection properties

TimeseriesML defines a generic collection feature type, Collection, to allow the grouping of observations and/or sampling features with metadata to describe the nature of the collection. Such collections are required in a number of data exchange scenarios; whether the underlying transport technology is web services, FTP or other technologies.

Property	Definition	Data types and values	Multiplicity
observationMember	One or more timeseries observations	OM_Observation	0..*
samplingFeatureMember	A sampling feature or group of sampling features.	SamplingFeatureMember	0..*
communityExtension	Use this extension point for community-agreed extensions to the schema.	Any	0..*

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internalExtension	Use this extension point for internal extensions that have not been defined for external use.	Any	0..*
generationDate	The date this data was generated.	TM_DateAndTime	1..1
generationSystem	The system from which this data was generated.	CharacterString	0..1
Version	This version property is distinct from the version of the TimeseriesML schema. It is a version of the whole standards package: schema, vocabularies, used profiles etc. I.e., a version to allow specific versions associated with usage of a schema version with other components.	Reference	0..1
temporalExtent	Describes the temporal extent of the all the timeseries contained within the collection (if they exist).	TM_Period	0..1
localDictionary	A dictionary containing definitions of terms.	Dictionary	0..*
sourceDefinition	Provides a context for identification of particular data elements through use of MD_DataIdentification. These can be referenced from individual timeseries values.	MD_DataIdentification	0..*
Parameter	A soft-typed parameter for extra metadata properties.	NamedValue	0..*
Profile	Profile may be used to reference a definition of a conformance class that this document conforms to.	Reference	0..*

6.15.1.2 SamplingFeatureMember properties

A sampling feature member may be either a single sampling feature (e.g., MonitoringFeature) or a group of features (SF_SamplingFeatureCollection). This is a Union class.

Property	Definition	Data types and values	Multiplicity
byGroup	A group of sampling features.	SF_SamplingFeatureCollection	0..1
byFeature	A sampling feature.	SF_SpatialSamplingFeature	0..1

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6.16 *Requirements Class*: MonitoringFeature

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-monitoring-feature	
Name	MonitoringFeature
Target Type	XML encoding
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-monitoring-feature
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules
Requirement	/req/xsd-monitoring-feature/valid The content model of this element shall have a value that matches the content model defined by tsml:MonitoringFeature.

6.16.1 Requirements class overview

The Monitoring Feature schema contains the definition of the Monitoring Feature type that is the (sampling) feature of interest of a TimeSeries observation.
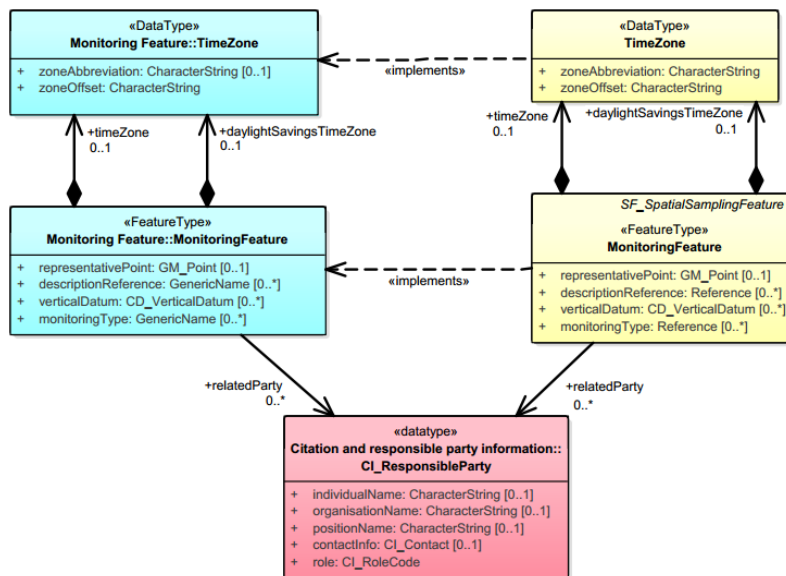

Figure 5 - MonitoringFeature Schema

6.16.1.1 MonitoringFeature properties

A MonitoringFeature is a spatial sampling feature (O&M) where observations are recorded. This monitoring feature often corresponds to a fixed instrument or monitoring site but it can also be an anonymous spatial location. The monitoring feature is a proxy for a real-world feature.

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Property	Definition	Data types and values	Multiplicity
daylightSavingsTimeZone	The timezone that the MonitoringFeature is located in when daylight savings applies.	TimeZone	0..1
timeZone	The timezone that the MonitoringFeature is located in.	TimeZone	0..1
relatedParty	The details of a party related to this MonitoringFeature. Multiple related parties may be described using the role code list (from ISO 19115). The most common relationships are likely to be: owner, originator, pointOfContact, principalInvestigator and distributor.	CI_ResponsibleParty	0..*
representativePoint	A point location that is representative of the monitoring feature's location. Typically this is used when the shape of the monitoring feature is an area or other non-point geometry. It may also be used to provide an approximate point location in sensitive observation scenarios.	GM_Point	0..1
descriptionReference	Provide extra descriptive information about a monitoring feature. This could be a link to an HTML page describing the location, photos of a monitoring point, history records etc.	Reference	0..*
verticalDatum	Specifies the elevation that is used as the zero point, or datum, for height-related measurements. The datum is defined using a vertical datum, which may be defined using the ISO19111 type CD_VerticalDatum, or an agreed upon datum may be reference by its identifier. E.g., the Australian Height Datum (AHD), Tasmania = "EPSG::5112". The CD_VerticalDatum type allows specification of the local vertical datum as a height above another reference datum. E.g., local vertical datum is 23m above the AHD.	CD_VerticalDatum	0..*

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Property	Definition	Data types and values	Multiplicity
monitoringType	A thematic characterisation of the type of monitoring feature. E.g., meteorological, surface water, groundwater, water quality etc.	Reference	0..*

6.16.1.2 TimeZone properties

Representation of a timezone.

Property	Definition	Data types and values	Multiplicity
zoneAbbreviation	Abbreviation for a timezone e.g., AEST.	CharacterString	0..1
zoneOffset	Time zone offset e.g., +10:00 GMT	CharacterString	1..1

6.17 *Requirements Class*: **MonitoringFeature as Feature of Interest**

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-monitoring-feature-feature-of-interest	
Name	MonitoringFeature as Feature of Interest
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-monitoring-feature-foi
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules
Requirement	/req/xsd-monitoring-feature-feature-of-interest/featureOfInterest The *featureOfInterest* element of TimeseriesObservation shall have a value that matches the content model defined by tsml:MonitoringFeature.

6.17.1 Requirements class overview

This requirements class captures the restriction of OM_Observation where the feature of interest is a monitoring feature. This class is to be used for most in-situ style monitoring situations where the TimeseriesML 1.3 monitoring feature is sufficient for representing the location metadata.

6.18 Requirements *Class*: ObservationProcess

Requirements Class	
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-observation-process	
Name	ObservationProcess
Target Type	XML encoding
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-observation-process
Dependency	http://www.opengis.net/spec/timeseriesrml/1.3/req/xsd-xml-rules
Requirement	/req/xsd-observation-process/valid The content model of this element shall have a value that matches the content model defined by tsml:ObservationProcess.

6.18.1 Requirements class overview

The ObservationProcess schema defines a basic process type that may be used to describe the procedure used in a TimeSeries Observation event.
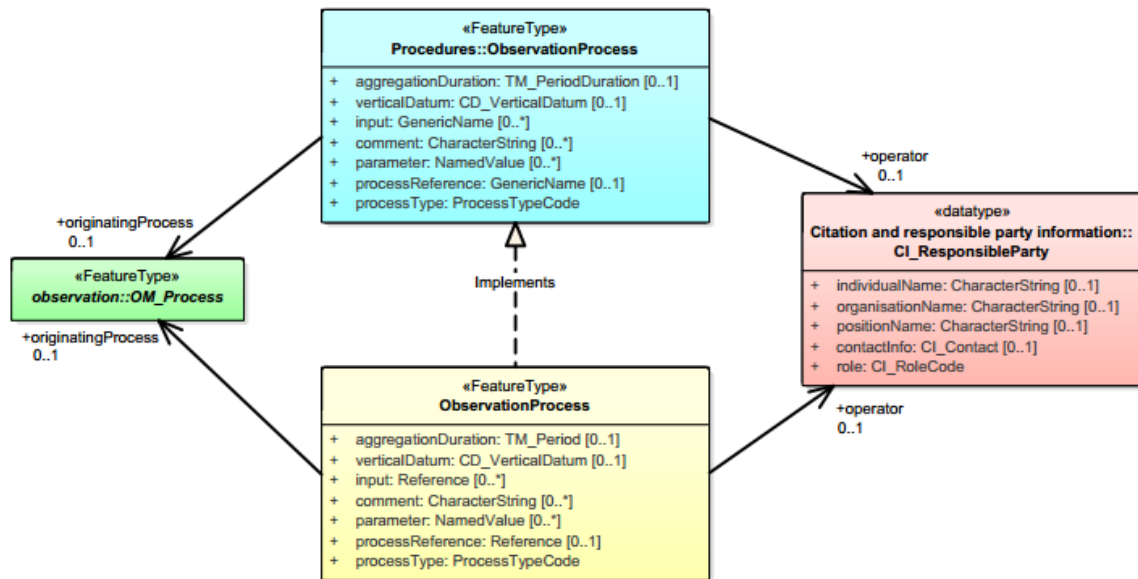

Figure 6 - ObservationProcess Schema

6.18.1.1 ObservationProcess properties

Information about the process used in the Observation.

Property	Definition	Data types and values	Multiplicity

|			
operator	Describes the party responsible for performing the process. E.g., the person performing the method or operating the sensor.	CI_ResponsibleParty	0..1
originatingProcess	Used to identify a process that is a source to this process. For example, an earlier processing step.	OM_Process	0..1
aggregationDuration	A list of the inputs used in the process. This may be a list of references to the data sets used (e.g., model input series) or an input array to an algorithm.	TM_PeriodDuration	0..1
verticalDatum	Specifies the datum that is used as the zero point for level measurements. This can be process-specific as opposed the gauge at the actual monitoring point.	CD_VerticalDatum	0..1
input	A list of the inputs used in the process. This may be a list of references to the data sets used (e.g., model input series) or an input array to an algorithm.	Reference	0..*
comment	Comments specific to the process from the operator.	CharacterString	0..*
parameter	A definition of the type of process used in the observation. This may be a Sensor, ManualMethod, Algorithm, or Simulation (including models).	NamedValue	0..*
processReference	Reference to an external process definition.	Reference	0..1
processType	A definition of the type of process used in the observation. This may be a Sensor, ManualMethod, Algorithm, or Simulation (including models).	ProcessTypeCode	1..1

6.19 *Requirements Class*: **Timeseries Metadata**

Requirements Class
http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-metadata
Name   Timeseries Metadata

Target Type	XML encoding
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-core
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-measurement-metadata
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-categorical-metadata
Requirement	/req/xsd-metadata/timeseries-metadata Metadata about the entire timeseries shall be provided using the tsml:TimeSeriesMetadata type.
Requirement	/req/xsd-metadata/point-metadata Metadata about individual data points shall be provided using the tsml:PointMetadata type
Requirement	/req/xsd-metadata/timeseries-comments Comments about the timeseries may be provided using the tsml:CommentBlock type.
Requirement	/req/xsd-metadata/timeseries-metadata-extension Metadata about a domain range timeseries shall be provided using the tsml:TimeseriesMetadataExtension type.

6.19.1 Requirements class overview

This requirement captures metadata requirements common across all timeseries classes.
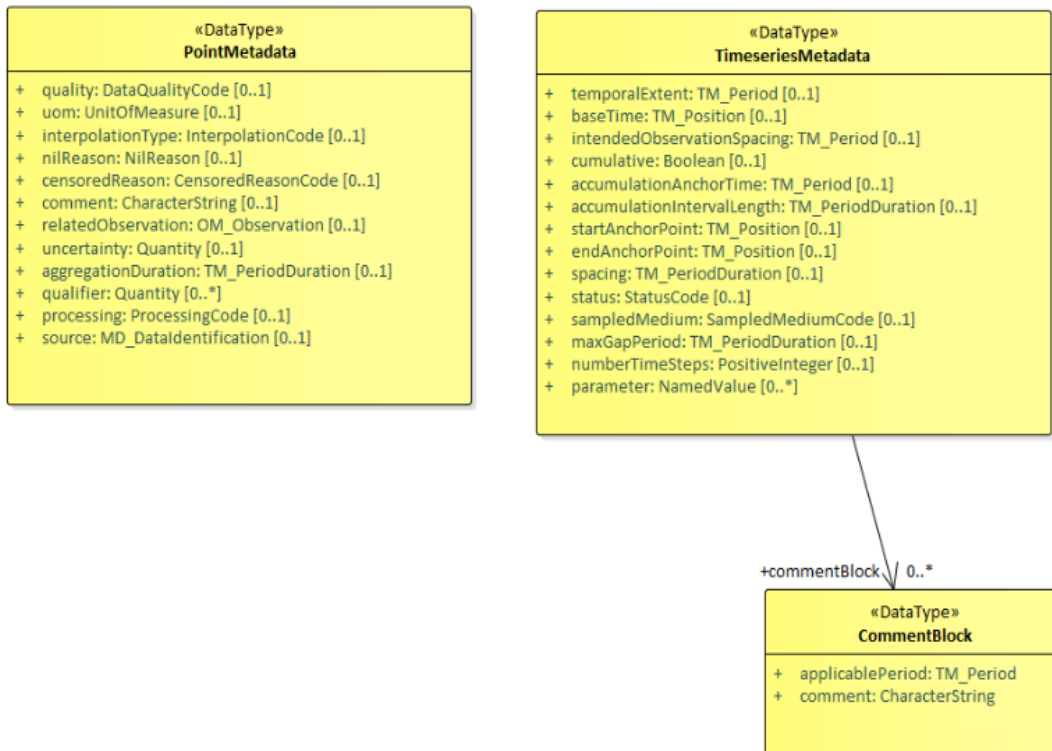
Figure 7 - TimeSeries Metadata XMLSchema Implementation

The XML Schema Implementation collapses many of the conceptual model metadata classes together for simplicity of encoding. There are three metadata classes:

- ObservationMetadata: Metadata about the whole timeseries observation;
- TimeseriesMetadata: Metadata about the whole timeseries or individual regularly spaced segments of an irregularly spaced whole timeseries; and
- PointMetadata: Metadata about individual points in the timeseries. PointMetadata may be set to a default across the whole timeseries and over-ridden for individual points.
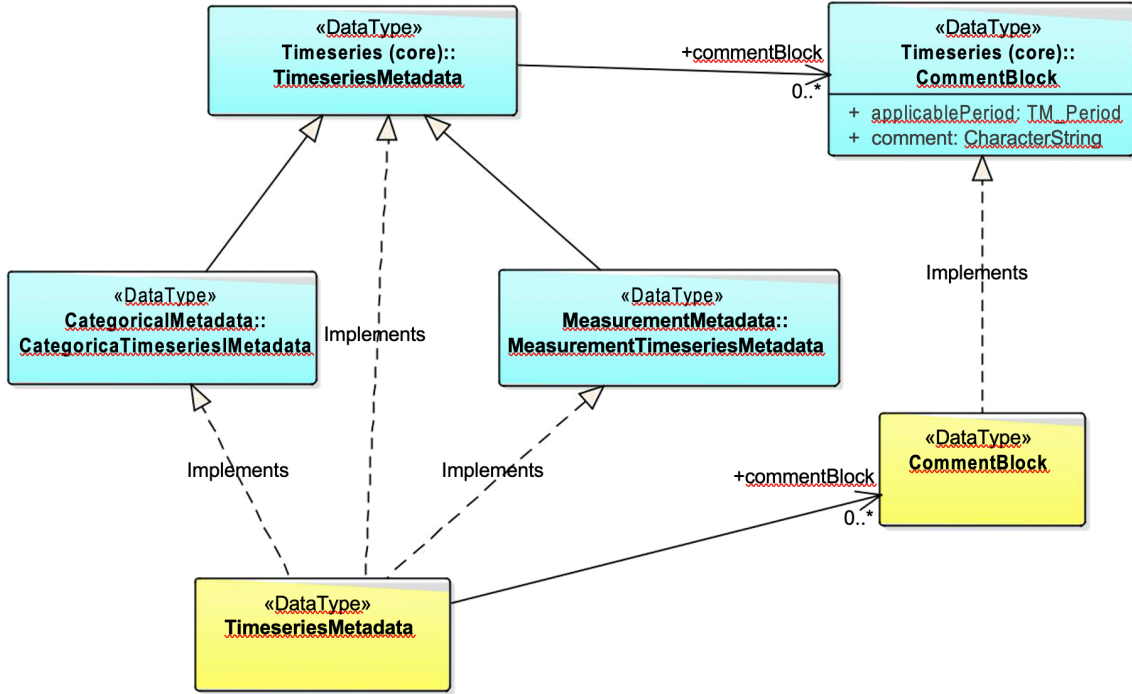
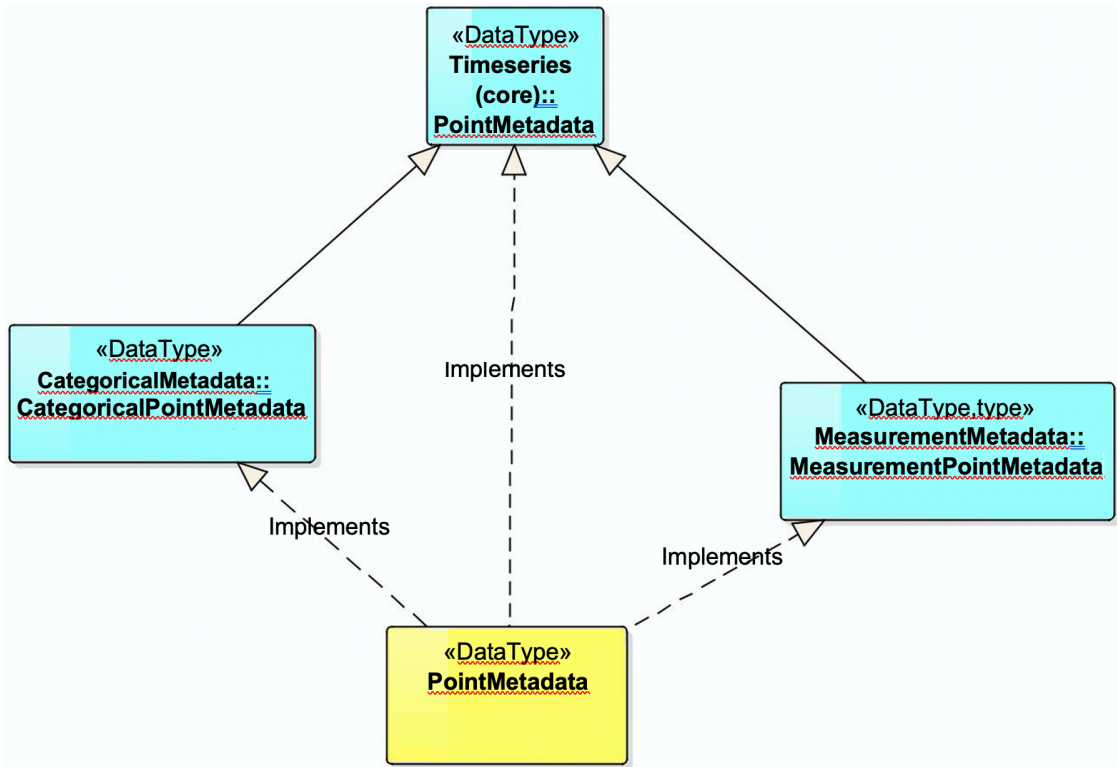**Figure 8 - Mapping of TimeseriesMetadata and CommentBlock to Conceptual Model**

Figure 9 - Mapping of XML Schema PointMetadata to Conceptual Model

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6.19.2 CommentBlock properties

Comment blocks may be used to make comment about the timeseries. Each comment applies to a specified period of the timeseries (it could apply to the whole timeseries).

Property	Definition	Data types and values	Multiplicity
applicablePeriod	The time period to which the comment applies.	TM_Period	1..1
comment	Free text comment about some aspect of the timeseries.	CharacterString	1..1

6.19.3 PointMetadata properties

Metadata relating to individual data points (can be set to a default for the whole timeseries).

Property	Definition	Data types and values	Multiplicity
quality	This property is for specifying a quality assertion using the TimeseriesML 1.3 defined concepts of quality as described in the DataQualityCode list. When a non-standard quality code is required a SWE Qualifier property shall be used.	DataQualityCode	0..1
uom	Unit of measure for the point data (typically a default will apply to the whole timeseries).	UnitOfMeasure	0..1
interpolationType	Defines the nature of the relationship between the time instant and the recorded value. For example, the value may represent an average across the time period since the last point (average in preceding interval). This value should be taken from the InterpolationCode list. The interpolation type is defined per point within the time series as it is possible for this to change mid series. Within the XML encoding it is possible to set a default interpolation for the series.	InterpolationCode	0..1
nilReason	This property describes the reason that a point has been identified as null. This provides context for interpreting null points (e.g., missing, withheld, etc.).	NilReason	0..1
censoredReason	Used to indicate the reason the value has been censored (e.g., below a threshold).	CensoredReasonCode	0..1

Property	Definition	Data types and values	Multiplicity
comment	Context information that does not fit into a controlled list of qualifiers, processing or quality information is often provided in free text per point. The comment property provides a placeholder for such textual information.	CharacterString	0..1
uncertainty	This property allows for a quantitative assertion of the estimated uncertainty of the measurement value. The term uncertainty is used here in line with 'measurement uncertainty' as defined in the International Vocabulary of Metrology (VIM3, http://www.bipm.org/en/publications/guides/vim.html), however it is acknowledged that it is still quite common practice (e.g., in instrument specifications) for the word accuracy to be used in place of uncertainty.	Quantity	0..1
relatedObservation	This property allows individual points to be associated with related observations. This is used when a timeseries consists of interleaved observations from different sources and understanding the relationship to existing observation(s) is important.	OM_Observation	0..1
aggregationDuration	Specifies the time period over which the values have been aggregated. E.g., 15 minutely.	TM_PeriodDuration	0..1
qualifier	A more loosely-typed qualifier that allows assertions using the SWE Common union (quality, categories etc.)	Quantity	0..*
processing	A code item indicating the processing that has occurred to the point.	ProcessingCode	0..1
source	A code item indicating the processing that has occurred to the point. By reference only.	MD_DataIdentification	0..1

6.19.4 TimeseriesMetadata properties

Metadata applicable to the whole timeseries or individual regularly spaced segments of an irregularly spaced whole timeseries.

Property	Definition	Data types and values	Multiplicity
commentBlock	Comment blocks may be used to make comment about the timeseries. Each comment applies to a specified period of the	CommentBlock	0..*

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	timeseries (it could apply to the whole timeseries).		
temporalExtent	The extent of the temporal domain of the timeseries. As the domain of the timeseries is temporal, the temporalExtent is a time period defining the start and end of its temporal domain (i.e., the start and end of the timeseries). Note that this often the same as the phenomenon time as specified in the OM_Observation; it is still useful here for timeseries that are described separately from an OM_Observation header.	TM_Period	0..1
baseTime	Timeseries that are regularly spaced, such as those that are generated from automatic sensors, can be represented without specifying the individual time instant for each point. The *spacing* property of the time series is used to specify the time between points. This is then used as the spacing for each point encountered, starting from the time set by *baseTime.*	TM_Position	0..1
intendedObservationSpacing	The extent of the temporal domain of the timeseries. As the domain of the timeseries is temporal, the temporalExtent is a time period defining the start and end of its temporal domain (i.e., the start and end of the timeseries). Note that this often the same as the phenomenon time as specified in the OM_Observation; it is still useful here for timeseries that are described separately from an OM_Observation header.	TM_Period	0..1
cumulative	This boolean property indicates whether the series is sequentially increasing and accumulates over time; i.e., each value is added to the last so the value represents the total of a value since accumulation began.	Boolean	0..1
accumulationAnchorTime	Defines the time at which accumulation begins. e.g., 9am.	TM_Period	0..1
accumulationIntervalLength	Defines the length of time over which accumulation is recorded e.g., 24 hours	TM_PeriodDuration	0..1

startAnchorPoint	StartAnchorPoint specifies a 'ghost' point to allow the first value of the timeseries to be interpolated correctly.	TM_Position	0..1
endAnchorPoint	EndAnchorPoint specifies a 'ghost' point to allow the last value of the timeseries to be interpolated correctly.	TM_Position	0..1
spacing	The time between points in a regularly spaced timeseries.	TM_PeriodDuration	0..1
status	Indicates the statues of the observation. E.g., unreleased, verified etc.	StatusCode	0..1
sampledMedium	Indicates the medium that was sampled. E.g., water, air, etc.	SampledMediumCode	0..1
maxGapPeriod	When any analysis is run over a timeseries it is important to know if it is possible to interpolate between any two adjoining points. If the join period between two adjoining points is greater than the maxGapPeriod then the series should not be interpolated between these adjoining points.	TM_PeriodDuration	0..1
numberTimeSteps	The number of time steps in a timeseries, or each homogenous (regularly spaced) segment of an irregularly spaced whole timeseries.	Integer	0..1
Parameter	This is a named value extension point that allows extra metadata to be added at the timeseries level. The parameters here are soft-typed (i.e., this standard does not define the properties semantics). Commonly used parameters here would be future candidates for definition within later versions or community extensions.	NamedValue	0..*

Annex A: Conformance Class Abstract Test Suite (Normative)

A.1   Conformance class: XML Rules

<table>
<tr><td colspan="3" align="center">Conformance Class</td></tr>
<tr><td colspan="3">http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-xml-rules</td></tr>
<tr><td>Dependency</td><td colspan="2">http://www.w3.org/TR/xmlschema-2</td></tr>
<tr><td>Dependency</td><td colspan="2">http://standards.iso.org/iso/8601/2004/4</td></tr>
<tr><td>Dependency</td><td colspan="2">http://www.opengis.net/doc/IS/GML/3.2#clause-2.4</td></tr>
<tr><td>Dependency</td><td colspan="2">http://www.opengis.net/spec/GML/3.3/req/definitions</td></tr>
<tr><td>Dependency</td><td colspan="2">http://www.opengis.net/spec/SWE/2.0/req/xsd-simple-components</td></tr>
<tr><td></td><td colspan="2">/conf/timeseriesml/1.3/req/xsd-xml-rules/iso8601-time</td></tr>
<tr><td></td><td>Requirement</td><td>/req/timeseriesml/1.3/req/xsd-xml-rules/iso8601-time</td></tr>
<tr><td></td><td>Test Purpose</td><td>Verify that all time instants are valid according to the XML Schema implementation of ISO8601.</td></tr>
<tr><td></td><td>Test Method</td><td>Validate the content of each time element against the XML Schema dateTime content type, available here http://www.w3.org/TR/xmlschema-2/#schema. Pass if no errors are reported. Fail otherwise.</td></tr>
<tr><td></td><td colspan="2">/conf/timeseriesml/1.3/req/xsd-xml-rules/time-zone</td></tr>
<tr><td></td><td>Requirement</td><td>/req/timeseriesml/1.3/req/xsd-xml-rules/time-zone</td></tr>
<tr><td></td><td>Test Purpose</td><td>Verify that all time instants include a time zone specifier.</td></tr>
<tr><td></td><td>Test Method</td><td>Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-xml-rules.sch. Pass if no errors are reported for the "time-zone" test. Fail otherwise.</td></tr>
<tr><td></td><td colspan="2">/conf/timeseriesml/1.3/req/xsd-xml-rules/unit-of-measure</td></tr>
<tr><td></td><td>Requirement</td><td>/req/timeseriesml/1.3/req/xsd-xml-rules/unit-of-measure</td></tr>
<tr><td></td><td>Test Purpose</td><td>Verify that all time units are specified using the UCUM units system.</td></tr>
</table>

	Test Method	Inspect the XML document and ensure all units of measure are valid according to UCUM. Fail otherwise. (No automated check against UCUM currently available).
	/conf/timeseriesml/1.3/req/xsd-xml-rules/swe-types	
	Requirement	/req/timeseriesml/1.3/req/xsd-xml-rules/swe-types
	Test Purpose	Ensure that only applicable SWE types are used. Some SWE types are related specifically to the SWE encoding style, which is not used. Verify that following SWE elements are not used in the encoding: - swe:quality(AbstractSimpleComponentType) - swe:nilValues (AbstractSimpleComponentType) - swe:constraint (QuantityType, QuantityRangeType, CategoryType) Verify the following SWE attributes are not used: - 'optional' and 'updatable' from the base type 'AbstractDataComponent'
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-xml-rules.sch. Pass if no errors are reported for the "swe-types" test. Fail otherwise.
	/conf/timeseriesml/1.3/rec/xsd-xml-rules/xlink-title	
	Requirement	/req/timeseriesml/1.3**rec**/xsd-xml-rules/xlink-title
	Test Purpose	Verify that an element using a xlink:href to encode reference a controlled vocabulary item also encodes a xlink:title attribute with a text description of the referenced item.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-xml-rules.sch. Pass if no errors are reported for the "xlink-title" test. Report otherwise.
	/conf/timeseriesml/1.3/rec/xsd-xml-rules/vocabulary-references	
	Requirement	/req/timeseriesml/1.3**rec**/xsd-xml-rules/vocabulary-references
	/conf/timeseriesml/1.3/rec/xsd-xml-rules/xlink-valid-local-reference	
	Requirement	/req/timeseriesml/1.3**rec**/xsd-xml-rules/xlink-valid-local-reference

	Test Purpose	Verify that the element referenced by a local xlink:href reference exists.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-xml-rules.sch. Pass if no errors are reported for the "xlink-valid-local-reference" test. Report otherwise.

A.2 Conformance class: Timeseries Observation

Conformance Class	
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-timeseries-observation	
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-domain-range-timeseries-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-categorical-domain-range-timeseries-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-measurement-domain-range-timeseries-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-tvp-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-categorical-timeseries-tvp-observation
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-measurement-timeseries-tvp-observation
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules
/conf/timeseriesml/1.3/req/xsd-timeseries-observation/procedure	

	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-observation/procedure
	Test Purpose	Verify that the om:procedure element has a value that matches the content model defined by tsml:ObservationProcess or an appropriate reference is used.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-timeseries-observation.sch. Pass if no errors are reported for the "procedure" test. Fail otherwise.

/conf/timeseriesml/1.3/req/xsd-timeseries-observation/phenomenonTime

	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-observation/phenomenonTime
	Test Purpose	Verify that the phenomenon time describes the temporal extent of the observation result.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-timeseries-observation.sch. Pass if no errors are reported for the "phenomenonTime" test. Fail otherwise.

A.3   Conformance class: Timeseries (TVP) Observation

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-timeseries-tvp-observation		
	/conf/timeseriesml/1.3/req/xsd-timeseries-tvp-observation/result	
	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-tvp-observation/result
	Test Purpose	Verify that the om:result element has a value that matches the content model defined by tsml:TimeseriesTVPType or is in the substitution group tsml:TimeseriesTVP.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-timeseries-tvp-observation.sch. Pass if no errors are reported. Fail otherwise.

A.4   Conformance class: Categorical Timeseries (TVP) Observation

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-categorical-timeseries-tvp-observation		
	/conf/timeseriesml/1.3/req/xsd-categorical-timeseries-tvp-observation/result	
	Requirement	/req/timeseriesml/1.3/req/xsd-categorical-timeseries-tvp-observation/result

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	Test Purpose	Verify that the om:result element has a value that matches the content model defined by tsml:CategoricalTVPType or is in the substitution group tsml:CategoricalTVP.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-categorical-timeseries-tvp-observation.sch. Pass if no errors are reported. Fail otherwise.

A.5   Conformance class: Measurement Timeseries (TVP) Observation

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-measurement-timeseries-tvp-observation		
	/conf/timeseriesml/1.3/req/xsd-measurement-timeseries-tvp-observation/result	
	Requirement	/req/timeseriesml/1.3/req/xsd-measurement-timeseries-tvp-observation/result
	Test Purpose	Verify that the om:result element has a value that matches the content model defined by tsml:MeasurementTVPType or is in the substitution group tsml:MeasurementTVP.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-measurement-timeseries-tvp-observation.sch. Pass if no errors are reported. Fail otherwise.

A.6   Conformance class: Timeseries (Domain Range) Observation

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-timeseries-domain-range-observation		
	/conf/timeseriesml/1.3/req/xsd-timeseries-domain-range-observation/result	
	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-domain-range-observation/result
	Test Purpose	Verify that the om:result element has a value that matches the content model defined by tsml:TimeseriesDomainRangeType or is in the substitution group tsml:TimeseriesDomainRange.

	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-timeseries-domain-range-observation.sch. Pass if no errors are reported. Fail otherwise.

A.7   Conformance class: Categorical Timeseries (Domain Range) Observation

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-categorical-timeseries-domain-range-observation		
	/conf/timeseriesml/1.3/req/xsd-categorical-timeseries-domain-range-observation/result	
	Requirement	/req/timeseriesml/1.3/req/xsd-categorical-timeseries-domain-range-observation/result
	Test Purpose	Verify that the om:result element has a value that matches the content model defined by tsml:TimeseriesDomainRangeType or is in the substitution group tsml:TimeseriesDomainRange and that all the range elements are of type Category.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-categorical-timeseries-domain-range-observation.sch. Pass if no errors are reported. Fail otherwise.

A.8   Conformance class: Measurement Timeseries (Domain Range) Observation

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-measurement-timeseries-domain-range-observation		
	/conf/timeseriesml/1.3/req/xsd-measurement-timeseries-domain-range-observation/result	
	Requirement	/req/timeseriesml/1.3/req/xsd-measurement-timeseries-domain-range-observation/result
	Test Purpose	Verify that the om:result element has a value that matches the content model defined by tsml:TimeseriesDomainRangeType or is in the substitution group tsml:TimeseriesDomainRange and that all the range elements are of type Quantity.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-measurement-timeseries-domain-range-observation.sch. Pass if no errors are reported. Fail otherwise.

A.9   Conformance class: Timeseries encoded as Time-Value Pairs

Conformance Class
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-timeseries-tvp

Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-core
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-tvp
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-categorical-timeseries-tvp
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-measurement-timeseries-tvp
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules

/conf/timeseriesml/1.3/req/xsd-timeseries-tvp/valid

Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-tvp/valid
Test Purpose	Verify that the XML instance is a valid timeseries.
Test Method	Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/1.3/timeseriesTVP.xsd. Pass if no errors are reported. Fail otherwise.

/conf/timeseriesml/1.3/req/xsd-timeseries-tvp/time-increasing

Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-tvp/time-increasing
Test Purpose	Verify that each point in the timeseries is increasing in time.
Test Method	Inspect the value of each tsml:time element in the series and ensure the time instant is after the previous tsml:time instant.

/conf/timeseriesml/1.3/req/xsd-timeseries-tvp/record-homogenous

Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-tvp/record-homogenous
Test Purpose	Verify that the record type for each point in the series is the same. E.g., all of type MeasurementTVP or CategoricalTVP.
Test Method	Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/1.3/timeseriesTVP.xsd. Pass if no errors are reported. Fail otherwise.

/conf/timeseriesml/1.3/req/xsd-timeseries-tvp/domain-time

	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-tvp/domain-time
	Test Purpose	Verify that the XML instance is a valid coverage timeseries consisting of single temporal element.
	Test Method	Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/1.3/timeseriesTVP.xsd. Pass if no errors are reported. Fail otherwise.

/conf/timeseriesml/1.3/req/xsd-timeseries-tvp/default-point-metadata

	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-tvp/default-point-metadata
	Test Purpose	Ensure the default metadata is applied to each point in the timeseries unless it has been overridden.
	Test Method	This requirement describes the logic for defaulting behavior. Conformance is to be tested when creating or parsing the instance document, rather than directly on an instance document.

/conf/timeseriesml/1.3/req/xsd-timeseries-tvp/equidistant-encoding

	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-tvp/equidistant-encoding
	Test Purpose	Ensure the equidistant timeseries metadata has been sufficiently defined.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-timeseries-tvp.sch. Pass if no errors are reported for the 'equidistant-encoding' test. Fail otherwise.

/conf/timeseriesml/1.3/req/xsd-timeseries-tvp/time-mandatory

	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-tvp/time-mandatory
	Test Purpose	Ensure that the time component of the timeseries coverage is sufficiently specified.Ensure each point in the series has a time specified, either through definition of an equidistant series or explicitly for each point.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-timeseries-tvp.sch. Pass if no errors are reported for the 'equidistant-encoding' test. Fail otherwise.

/conf/timeseriesml/1.3/req/xsd-timeseries-tvp/null-value

	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-tvp/null-value

	Test Purpose	Ensure that @xsi:nil = 'true' is specified for each point that is defined as null.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-timeseries-tvp.sch. Pass if no errors are reported for the 'null-value' test. Fail otherwise.
/conf/timeseriesml/1.3/req/xsd-timeseries-tvp/null-point-reason		
	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-tvp/null-point-reason
	Test Purpose	Ensure that a reason is specified for each point that is defined as null.
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-timeseries-tvp.sch. Pass if no errors are reported for the 'null-point-reason' test. Fail otherwise.
/conf/timeseriesml/1.3/rec/xsd-timeseries-tvp/nil-reason-vocab		
	Requirement	/req/timeseriesml/1.3/rec/xsd-timeseries-tvp/nil-reason-vocab
	Test Purpose	Ensure that where a nilreason is provided it comes from the OGC nils vocabulary at http://www.opengis.net/def/nil/
	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-timeseries-tvp.sch. Pass if no errors are reported for the 'nil-reason-vocab' test. Fail otherwise

A.10 Conformance class: Categorical (TVP) Timeseries

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-categorical-timeseries-tvp		
	/conf/timeseriesml/1.3/req/xsd-categorical-timeseries-tvp/value-category	
	Requirement	/req/timeseriesml/1.3/req/xsd-categorical-timeseries-tvp/value-category
	Test Purpose	Verify that each point in the timeseries has a value-type of a category.

	Test Method	Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/1.3/timeseriesTVP.xsd and the Schematron document http://schemas.opengis.net/waterml/2.0/xsd-categorical-timeseries-tvp.sch. Pass if no errors are reported. Fail otherwise.

A.11 Conformance class: Measurement (TVP) Timeseries

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-measurement-timeseries-tvp		
	/conf/timeseriesml/1.3/req/xsd-measurement-timeseries-tvp/value-measure	
	Requirement	/req/timeseriesml/1.3/req/xsd-measurement-timeseries-tvp/value-measure
	Test Purpose	Verify that each point in the timeseries has a value-type of a measure.
	Test Method	Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/1.3/timeseriesTVP.xsd. Pass if no errors are reported. Fail otherwise.

A.12 Conformance class: Timeseries encoded as Domain Range

Conformance Class	
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-timeseries-dr	
Dependency	http://www.opengis.net/doc/GML/GMLCOV/1.0.1#clause-6
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-core
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-domain-range
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-measurement-timeseries-domain-range
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-categorical-timeseries-domain-range

		/conf/timeseriesml/1.3/req/xsd-timeseries-dr/valid
	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-dr/valid
	Test Purpose	Verify that the XML instance is a valid timeseries.
	Test Method	Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/1.3/timeseriesDR.xsd. Pass if no errors are reported. Fail otherwise.
		/conf/timeseriesml/1.3/req/xsd-timeseries-dr/time-increasing
	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-dr/time-increasing
	Test Purpose	Verify that each point in the timeseries is increasing in time.
	Test Method	Inspect the value of each element in the coverage domain and ensure the time instant is after the previous instant.
		/conf/timeseriesml/1.3/req/xsd-timeseries-dr/record-homogenous
	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-dr/record-homogenous
	Test Purpose	Verify that the record type for each point in the series is the same.
	Test Method	Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/1.3/timeseriesDR.xsd. Pass if no errors are reported. Fail otherwise.
		/conf/timeseriesml/1.3/req/xsd-timeseries-dr/domain-time
	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-dr/domain-time
	Test Purpose	Verify that the XML instance is a valid coverage timeseries consisting of single temporal element.
	Test Method	Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/1.3/timeseriesDR.xsd. Pass if no errors are reported. Fail otherwise.
		/conf/timeseriesml/1.3/req/xsd-timeseries-dr/default-point-metadata
	Requirement	/req/timeseriesml/1.3/req/xsd-timeseries-dr/default-point-metadata
	Test Purpose	Ensure the default metadata is applied to each point in the timeseries unless it has been overridden.

	Test Method	This requirement describes the logic for defaulting behavior. Conformance is to be tested when creating or parsing the instance document, rather than directly on an instance document.

A.13 Conformance class: Collection

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-collection		
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-collection	
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-sampling-feature-collections	
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules	
/conf/timeseriesml/1.3/req/xsd-collection/valid		
	Requirement	/req/timeseriesml/1.3/req/xsd-collection/valid
	Test Purpose	Verify that the tsml:Collection is valid.
	Test Method	Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/1.3/collection.xsd. Pass if no errors are reported. Fail otherwise.
/conf/timeseriesml/1.3/req/xsd-collection/sampling-feature-single		
	Requirement	/req/timeseriesml/1.3/req/xsd-collection/sampling-feature-single
	Test Purpose	Verify that each point in the timeseries is increasing in time.
	Test Method	Verify that the tsml:samplingFeatureMember element has a value that matches the content model defined by sams:SF_SamplingFeature (or derivative) or an appropriate reference is used.
/conf/timeseriesml/1.3/req/xsd-collection/sampling-feature-group		
	Requirement	/req/timeseriesml/1.3/req/xsd-collection/sampling-feature-group
	Test Purpose	Verify that the record type for each point in the series is the same.
	Test Method	Verify that the tsml:samplingFeatureMember element has a value that matches the content model defined by sams:SF_SamplingFeatureCollection or an appropriate reference is used.

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A.14 Conformance class: MonitoringFeature

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-monitoring-feature		
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-monitoring-feature	
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules	
	/conf/timeseriesml/1.3/req/xsd-monitoring-feature/valid	
	Requirement	/req/timeseriesml/1.3/req/xsd-monitoring-feature/valid
	Test Purpose	Verify that the tsml:Collection is valid.
	Test Method	Verify that the tsml:MonitoringFeature is valid. Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/2.0/monitoringFeature.xsd. Pass if no errors are reported. Fail otherwise.

A.15 Conformance class: MonitoringFeature as Feature of Interest

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-monitoring-feature-feature-of-interest		
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/observation	
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-observation	
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-monitoring-feature-foi	
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules	
	/conf/timeseriesml/1.3/req/xsd-monitoring-feature-feature-of-interest/featureOfInterest	
	Requirement	/req/timeseriesml/1.3/req/xsd-monitoring-feature-feature-of-interest/featureOfInterest
	Test Purpose	Verify that the om:featureOfInterest element has a value that matches the content model defined by tsml:MonitoringFeature.

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	Test Method	Validate the XML document using the Schematron document http://schemas.opengis.net/tsml/1.3/schematron/xsd-monitoring-feature-feature-of-interest.sch. Pass if no errors are reported. Fail otherwise.

A.16 Conformance class: ObservationProcess

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-observation-process		
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-observation-process	
Dependency	http://www.opengis.net/spec/timeseriesrml/1.3/req/xsd-xml-rules	
	/conf/timeseriesml/1.3/req/xsd-observation-process/valid	
	Requirement	/req/timeseriesml/1.3/req/xsd-observation-process/valid
	Test Purpose	Verify that the tsml:ObservationProcess is valid.
	Test Method	Validate the XML document using the XML Schema document http://schemas.opengis.net/tsml/1.3/observationProcess.xsd. Pass if no errors are reported. Fail otherwise.

A.17 Conformance class: Timeseries Metadata

Conformance Class		
http://www.opengis.net/spec/timeseriesml/1.3/conf/xsd-metadata		
Dependency	http://www.opengis.net/spec/timeseriesml/1.3/req/xsd-xml-rules	
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-timeseries-core	
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-measurement-metadata	
Dependency	http://www.opengis.net/spec/timeseries/1.3/req/uml-categorical-metadata	
	/conf/timeseriesml/1.3/req/xsd-metadata/timeseries-metadata	
	Requirement	/req/timeseriesml/1.3/req/xsd-metadata/timeseries-metadata

	Test Purpose	Verify that the tsml:Timeseries/tsml:metadata element has a value that matches the content model defined by tsml:TimeseriesMetadata.
	Test Method	Validate the XML document using the XML Schema Document http://schemas.opengis.net/tsml/1.3/timeseriesTVP.xsd. Pass if no errors are reported. Fail otherwise.

/conf/timeseriesml/1.3/req/xsd-metadata/point-metadata

	Requirement	/req/timeseriesml/1.3/req/xsd-metadata/point-metadata
	Test Purpose	Verify that the tsml:CategoricalTVP/tsml:metadata and tsml:MeasurementTVP/tsml:metadata elements have a value that matches the content model defined by tsml:PointMetadata.
	Test Method	Validate the XML document using the XML Schema Document http://schemas.opengis.net/tsml/1.3/timeseriesTVP.xsd. Pass if no errors are reported. Fail otherwise.

/conf/timeseriesml/1.3/req/xsd-metadata/timeseries-comments

	Requirement	/req/timeseriesml/1.3/req/xsd-metadata/timeseries-comments
	Test Purpose	Verify that the tsml:TimeseriesMetadata/tsml:commentBlock element has a value that matches the content model defined by tsml:TimeseriesMetadata.
	Test Method	Validate the XML document using the XML Schema Document http://schemas.opengis.net/tsml/1.3/timeseriesMetadata.xsd. Pass if no errors are reported. Fail otherwise.

/conf/timeseriesml/1.3/req/xsd-metadata/timeseries-metadata-extension

	Requirement	/req/timeseriesml/1.3/req/xsd-metadata/timeseries-metadata-extension
	Test Purpose	Verify that the tsml:TimeseriesDomainRange/tsml:metadata element has a value that matches the content model defined by tsml:TimeseriesMetadataExtension.
	Test Method	Validate the XML document using the XML Schema Document http://schemas.opengis.net/tsml/1.3/timeseriesDR.xsd. Pass if no errors are reported. Fail otherwise.

Annex B: Codelists (informative)

This annex contains copies of codelists that are initially defined in the OGC Timeseries Profile of Observations and Measurements and used in the TimeseriesML XML encoding.

They are reproduced in this standard for convenience only. The normative definitions are not maintained in this standard.

Normative definitions can be found at http://opengis.net/def/timeseries/1.3 and are maintained outside of this specification.

B.1   DataQualityCode Codelist

Terms in this codelist are used to indicate the quality of individual data points.

Table 5 - Values from the DataQualityCode codelist

Code	Label	Definition
http://opengis.net/def/timeseries/1.3/DataQualityCode/Good	Good	The data has been examined and represents a reliable measurement.
http://opengis.net/def/timeseries/1.3/DataQualityCode/Suspect	Suspect	The data should be treated as suspect.
http://opengis.net/def/timeseries/1.3/DataQualityCode/Estimate	Estimate	The data is an estimate only, not a direct measurement.
http://opengis.net/def/timeseries/1.3/DataQualityCode/Poor	Poor	The data should be considered as low quality and may have been rejected.
http://opengis.net/def/timeseries/1.3/DataQualityCode/Unchecked	Unchecked	The data has not been checked by any qualitative method.
http://opengis.net/def/timeseries/1.3/DataQualityCode/Missing	Missing	The data is missing.

B.2   InterpolationCode Codelist

Terms in this codelist are used to indicate how data should be interpolated between neighboring points in a timeseries.

Table 6 - Values from the InterpolationCode codelist

Code	Label	Definition

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http://opengis.net/def/timeseries/1.3/ InterpolationCode/Continuous	Continuous	A continuous time series indicates the observation result is the value of a property at the indicated instant in time. The points are essentially connected and interpolation may occur between points in order to estimate the value of the property between points. The appropriate time spacing between successive points to minimize interpolation errors is related to rate of change (w.r.t. time) of the property.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/Discontinuous	Discontinuous	The sampling of the property occurs such that it is not possible to regard the series as continuous. The time between samples is too large to classify the measurements as continuous. Example: An infrequent water sample measuring pH.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/InstantTotal	Instant Total	Value represents a total attributed to a specific time instant. This is normally generated from an event-based measuring device. Example: An individual tip of a tipping bucket rain gauge.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/AveragePrec	Average Preceding	Value represents the average value over the preceding interval.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/MaxPrec	Maximum Preceding	Value represents the maximum value that was measured during the preceding time interval.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/MinPrec	Minimum Preceding	Value represents the minimum value that was measured during the preceding time interval.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/PrecTotal	Preceding Total	Value represents the total of measurements taken within the previous time interval.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/AverageSucc	Average Succeeding	Value represents the average value over the following interval.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/TotalSucc	Total Succeeding	Value represents the average value over the following interval.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/MinSucc	Minimum Succeeding	Value represents the minimum value for the following interval.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/MaxSucc	Maximum Succeeding	Value represents the maximum value for the following interval.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/ConstPrec	Constant Preceding	Value is constant in the preceding interval.
http://opengis.net/def/timeseries/1.3/ InterpolationCode/ConstSucc	Constant Succeeding	Value is constant in the succeeding interval.

B.3 ProcessTypeCode Codelist

Terms from this codelist are used to indicate the type of process that was used in an observation.

Table 7 - Values from the ProcessTypeCode codelist

Code	Label	Definition
`http://opengis.net/def/timeseries/1.3/ProcessTypeCode/Algorithm`	Algorithm	Timeseries data is generated by applying an algorithm to input data
`http://opengis.net/def/timeseries/1.3/ProcessTypeCode/ManualMethod`	Manual Method	Timeseries data is collected manually
`http://opengis.net/def/timeseries/1.3/ProcessTypeCode/Sensor`	Sensor	Timeseries data is collected from an automated sensor
`http://opengis.net/def/timeseries/1.3/ProcessTypeCode/Simulation`	Simulation	Timeseries is generated from a simulation
`http://opengis.net/def/timeseries/1.3/ProcessTypeCode/Unknown`	Unknown	Timeseries is collected or generated by an unknown process

B.4 ProcessingCode Codelist

The contents of this codelist are not defined in the Timeseries Profile. It is a stub for any community or vendor specific codelist that defines processing codes relevant to timeseries observations (for example to indicate what processing level or step has been reached).

B.5 SampledMediumCode Codelist

The contents of this codelist are not defined in the Timeseries Profile. It is a stub for any community or vendor specific codelist that defines codes for sampled media relevant to timeseries observations.

B.6 StatusCode Codelist

The contents of this codelist are not defined in the Timeseries Profile. It is a stub for any community or vendor specific codelist that defines status codes relevant to timeseries observations (for example to indicate what verification checks have taken place).

Annex C: Mapping of TimeseriesML 1.0 XML Schema types to WaterML2.0 XML Schema types

This annex contains a mapping of the TimeseriesML1.0 XML Schema to the WaterML 2.0 XML Schema.

In the TimeseriesML XML Schema implementation emphasis has been placed on minimizing the number of classes. This has been achieved by a combination of soft typing and by merging classes where appropriate (e.g., ObservationMetadata and TimeseriesMetadata are merged in the Timeseries conceptual model).

WaterML2.0 Part 1 XML Schema Type	TimeseriesML XML Schema Type	Notes
DocumentMetadata *collection.xsd*	None	DocumentMetadata has been removed as a separate type. Properties of the WML2 DocumentMetadata class have been included in the TSML Collection.
Collection *collection.xsd*	Collection *collection.xsd*	Addition of DocumentMetadata properties to the Collection type.
SamplingFeatureMember *collection.xsd*	SamplingFeatureMember *collection.xsd*	
Timeseries *timeseries.xsd*	TimeseriesTVP *timeseries.xsd*	
MeasurementTimeseries *timeseries.xsd*	TimeseriesTVP *timeseries.xsd*	Soft typing, primary distinction is in the encoding of the time-value pairs.
CategoricalTimeseries *timeseries.xsd*	TimeseriesTVP *timeseries.xsd*	Soft typing, primary distinction is in the encoding of the time-value pairs.
TimeseriesMetadata *timeseries.xsd*	TimeseriesMetadata *timeseriesMetadata.xsd*	
MeasurementTimeseriesMetadata *timeseries.xsd*	TimeseriesMetadata *timeseriesMetadata.xsd*	No distinction made between timeseries-level metadata type for Measure and Categoricaltimeseries.

ObservationMetadata *timeseriesObservationMetadata.xsd*	None	ObservationMetadata has been removed however properties of the class were retained and added to TimeseriesMetadata. ObservationMetadata in WaterML2 specialized 19115 MD_Metadata. 19115 MD_Metadata may still be supplied using the om:metadata association role of OM_Observation.
TVPMetadata *timeseries.xsd*	PointMetadata *timeseriesMetadata.xsd*	
TVPMeasurementMetadata *timeseries.xsd*	PointMetadata *timeseriesMetadata.xsd*	No distinction made between point-level metadata type for Measure and Categorical timeseries. Both use the same PointMetadata type.
DefaultCategoricalTVPMetadata *timeseries.xsd*	PointMetadata *timeseriesMetadata.xsd*	No distinction made between point-level metadata type for Measure and Categorical timeseries. Both use the same PointMetadata type.
MeasurementTVP *timeseries.xsd*	MeasurementTVP *timeseriesTVP.xsd*	
CategoricalTVP *timeseries.xsd*	CategoricalTVP *timeseriesTVP.xsd*	
Measure *timeseries.xsd*	Measure *timeseriesTVP.xsd*	
CommentBlock *timeseries.xsd*	CommentBlock timeseriesMetadata.xsd	
ObservationProcess *observationProcess.xsd*	ObservationProcess *observationProcess.xsd*	Schema is not restricted to use of ObservationProcess. Any valid derivation of OM_Process or SWE AbstractProcess may be used.

MonitoringPoint *monitoringPoint.xsd*	MonitoringFeature *monitoringFeature.xsd*	No longer restricted to point monitoring features. Same inheritance from SF_SpatialSamplingFeature.
TimeZone *monitoringPoint.xsd*	TimeZone *monitoringFeature.xsd*	
TimeListSimple *timeseries-domain-range.xsd* *[Informative]*	TimeListSimple *timeseriesDR.xsd*	
TimePositionList timeseries-domain-range.xsd *[Informative]*	TimePositionList *timeseriesDR.xsd*	
AnnotationCoverage *timeseries-domain-range.xsd* *[Informative]*	AnnotationCoverage *timeseriesDR.xsd*	
TimeseriesCoverage *timeseries-domain-range.xsd* *[Informative]*	None *timeseriesDR.xsd*	No new coverage types are defined.
TimeseriesDomainRange *timeseries-domain-range.xsd* *[Informative]*	TimeseriesDomainRange *timeseriesDR.xsd*	
MeasurementTimeseriesCoverage *timeseries-domain-range.xsd* *[Informative]*	None	No new coverage types are defined.
MeasurementTimeseriesDomainRange *timeseries-domain-range.xsd* *[Informative]*	TimeseriesDomainRange *timeseriesDR.xsd*	Soft-typing

CategoricalTimeseriesCoverage *timeseries-domain-range.xsd* *[Informative]*	None	No new coverage types are defined.
CategoricalTimeseriesDomainRange *timeseries-domain-range.xsd* *[Informative]*	TimeseriesDomainRange *timeseriesDR.xsd*	Soft-typing
MeasurementTimeseriesMetadataExtension *timeseries-domain-range.xsd* *[Informative]*	TimeseriesMetadataExtension *timeseriesDR.xsd*	Soft-typing
CategoricalTimeseriesMetadataExtension *timeseries-domain-range.xsd* *[Informative]*	TimeseriesMetadataExtension *timeseriesDR.xsd*	Soft-typing

Annex D: Additions/Modifications to TimeseriesML 1.0 XML Schema

This annex contains additions/modifications to the TimeseriesML 1.0 XML Schema.

Updated TimeseriesML XML Schema Type	TimeseriesML XML Schema	Notes
TimePeriodList (Version 1.2)	timeseriesDR.xsd	Previously, the TimeseriesML Domain-Range schema only allowed for a list of instantaneous time positions to be encoded under the gml:domainSet element (TimePositionList). An amendment to the timeseriesDR.xsd allows the encoding of a list of Time Periods, which contain both a beginning dateTime and an ending dateTime. This has been added primarily to denote an observation's valid time that spans a range in time. For example, a maximum temperature that is valid from 12Z to 00Z needs a valid time that is denoted by both a beginning and ending time. Version 1.2 contains this update.

| timeseriesMetadata (Version 1.2) | timeseriesDR.xsd

timeseriesMetadata.xsd | In order to accommodate metadata applicable to an irregularly spaced whole timeseries for Domain- Range encoding, an amendment to increase the cardinality of timeseriesMetadata from "1" to "unbounded" has been added to timeseriesDR.xsd.

The amendment allows for dividing the entire irregularly spaced timeseries with different time spacings into segments that do contain regularly spaced time steps. Metadata can then be used to describe each of these individual segments. The amendment also necessitates an update to the documentation of both timeseriesMetadata in timeseriesDR.xsd and its child element TimeseriesMetadata in timeseriesMetadata.xsd to denote that metadata can be applied to the whole timeseries or individual regularly spaced segments of the whole irregularly spaced timeseries. Version 1.2 contains this update. |

numberTimeSteps (Version 1.3)	timeseriesMetadata.xsd	This amendment allows for a specific 'count' of the number of time steps in a timeseries, or each homogenous (regularly spaced) segment of an irregularly spaced whole timeseries. It is an optional TimeseriesMetadata property of type Integer for both the TVP and Domain-Range encodings. TimeseriesMetadata is of type "tsml:TimeseriesMetadataType". The additional property will be added to this type. Version 1.3 contains this update.