Approach for Dynamic Data Schema CityGML 3.0

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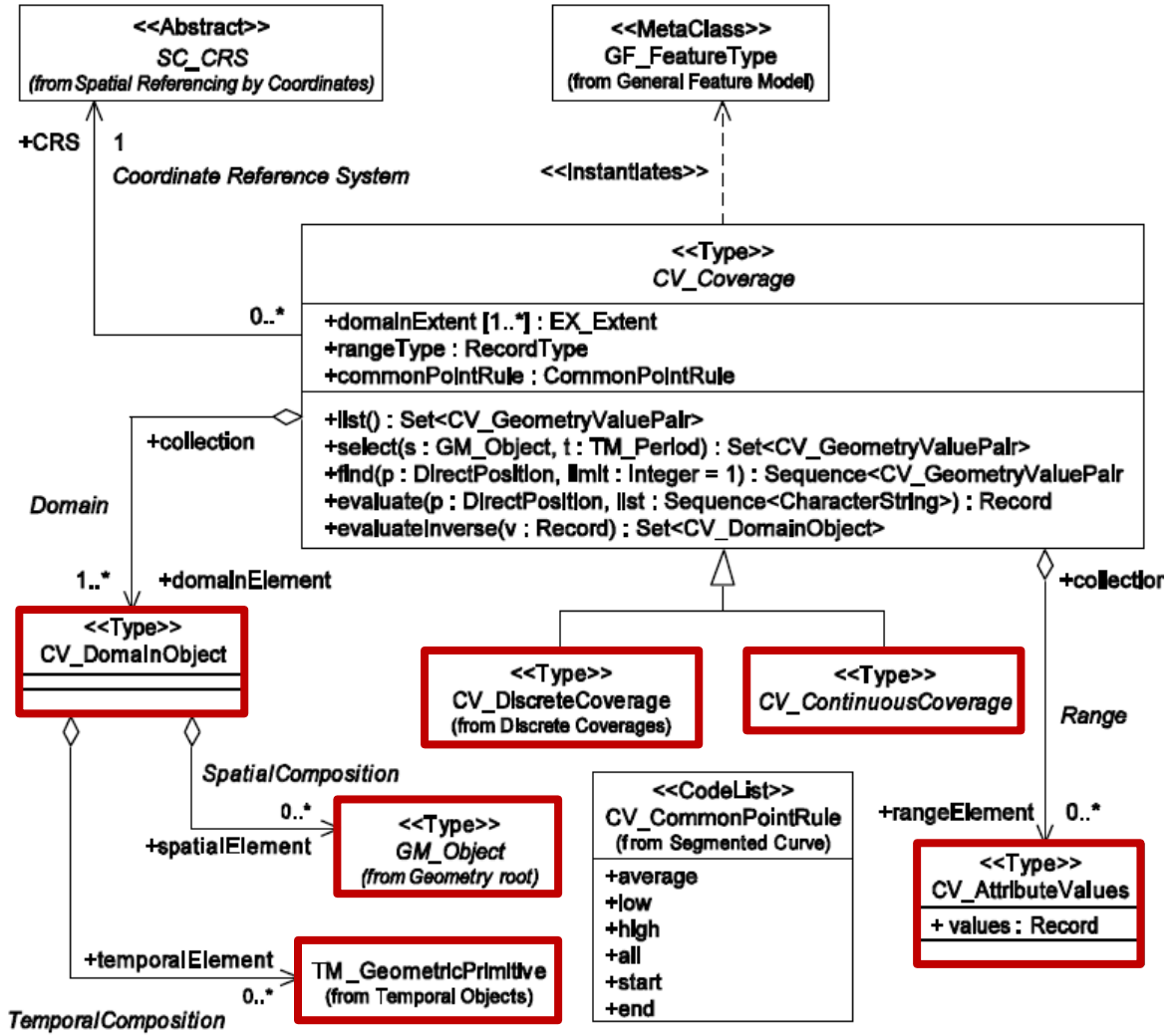
Agenda

- Is it possible to support interpolation within coverages?
  - Continuous coverages in ISO 19123 – Schema for coverage geometry and functions
  - Interpolation in WaterML 2.0 – Timeseries
- Is it possible to support patterns within our approach?
- Is it possible to support spatial components (geometries) within the Range Set of Coverages?

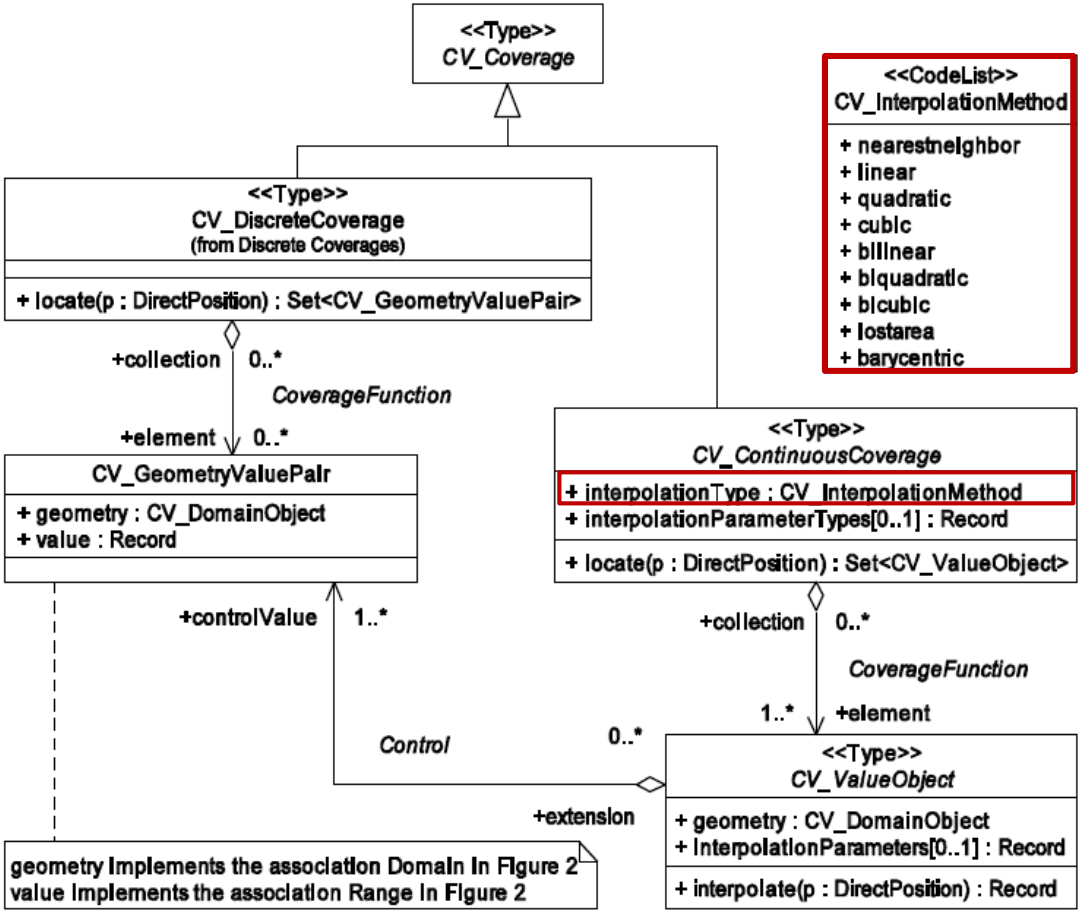
ISO 19123 - Schema for coverage geometry and functions

ISO 19123 - Schema for coverages



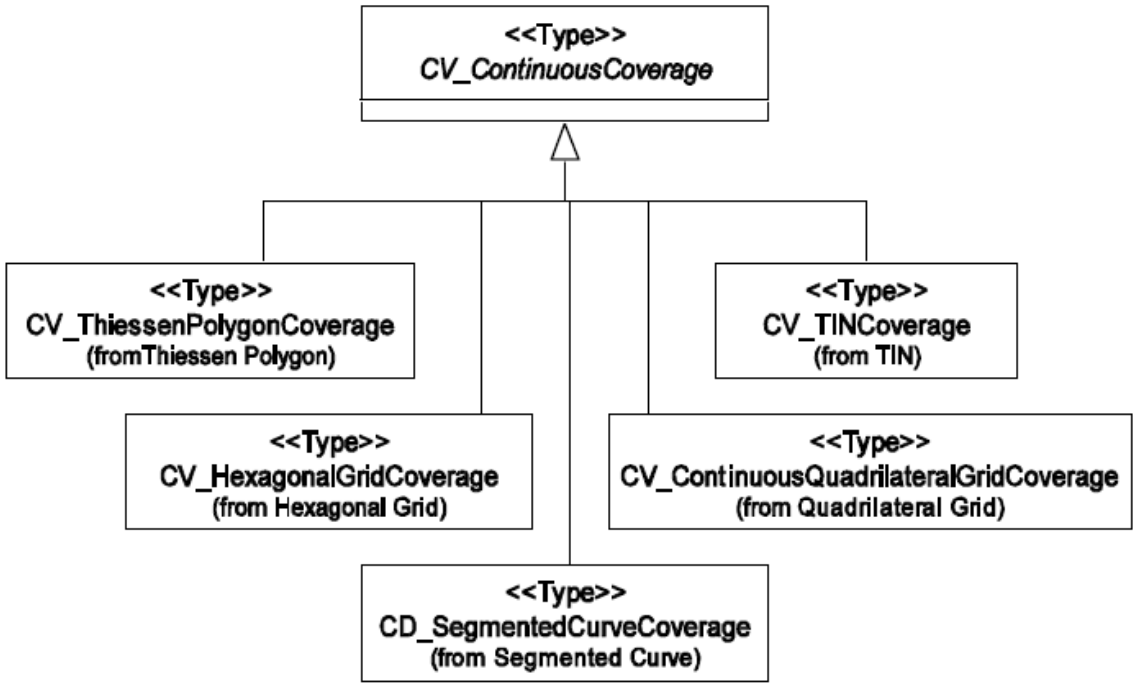
Source : [ISO 19123 - Schema for coverage geometry and functions]

ISO 19123 - Schema for coverages



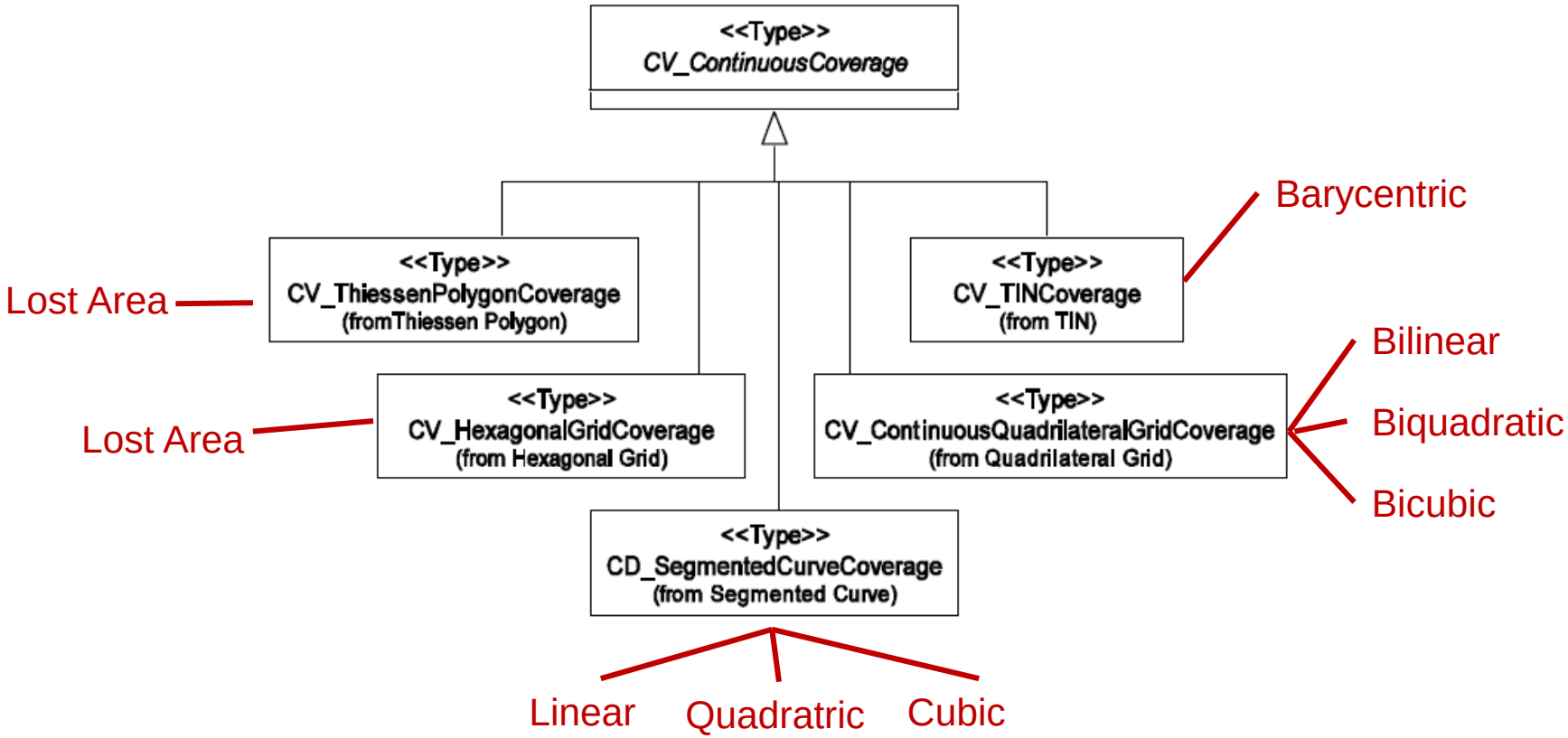
Source : [ISO 19123 - Schema for coverage geometry and functions]

Types of Continuous Coverages



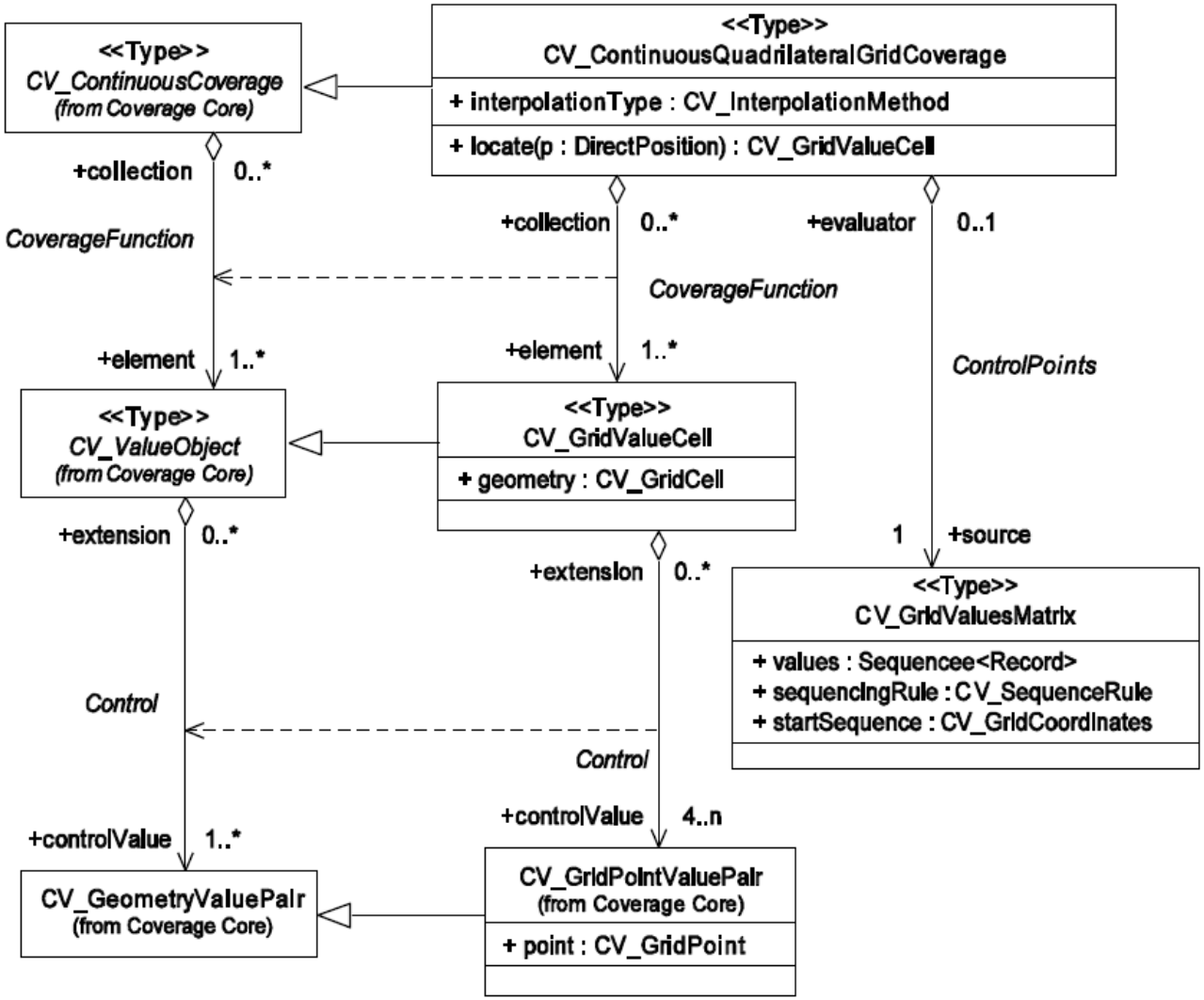
Source : [ISO 19123 - Schema for coverage geometry and functions]

Supported Interpolation Methods



Source : [ISO 19123 - Schema for coverage geometry and functions]

Interpolation in Continuous Grid Coverages



Source : [ISO 19123 - Schema for coverage geometry and functions]

State of Continuous Coverages

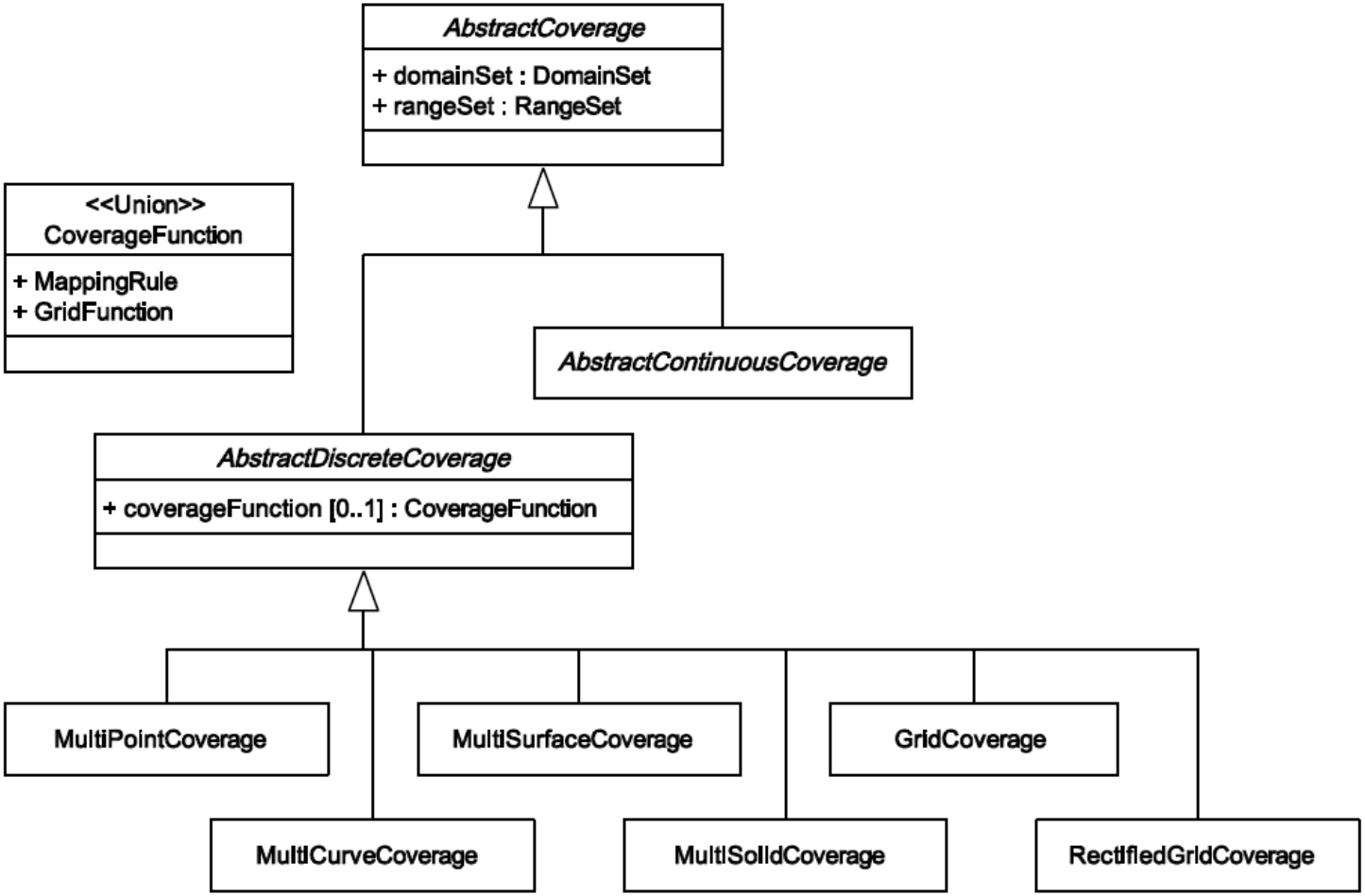
- Not supported by GML 3.2.1and GML 3.3

Change	Rationale
All subclasses of CV_ContinuousCoverage deleted	Currently not supported by GML.
Coordinate Reference System association deleted from CV_Coverage	Replaced by srsName (or frame) attributes on the Geometry or Temporal objects in the domain. The GML coverage package allows for domain objects to be in different coordinate reference systems (or reference frames).
CV_CommonPointRule deleted	Currently not supported by GML.
AttributeValues deleted	Replaced by a choice between the GML analogues: ValueArray or AbstractScalarValueList.
CV_GeometryValuePair deleted	The GML coverage encodes only the domain-range functional viewpoint.
CV_GridValuesMatrix deleted	The mapping between grid points and range values including sequence rule, etc. is contained in an object (GridFunction) that does not inherit from Grid.
CV_GridCell	Currently not supported by GML.

Source : [OGC 07-036 GML Encoding Standard]

State of Continuous Coverages

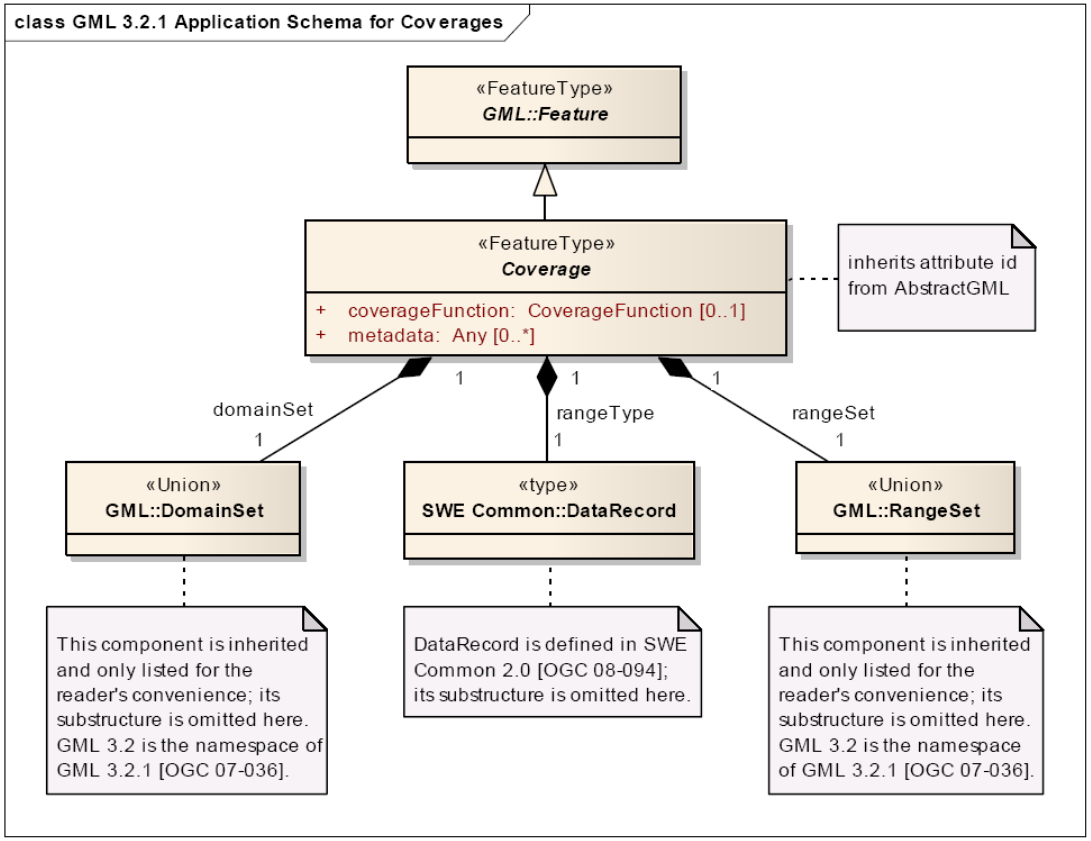
- All subclasses of CV_ContinuousCoverage deleted in GML 3.2.1



Source : [OGC 07-036 GML Encoding Standard]

GMLCOV Application Schema

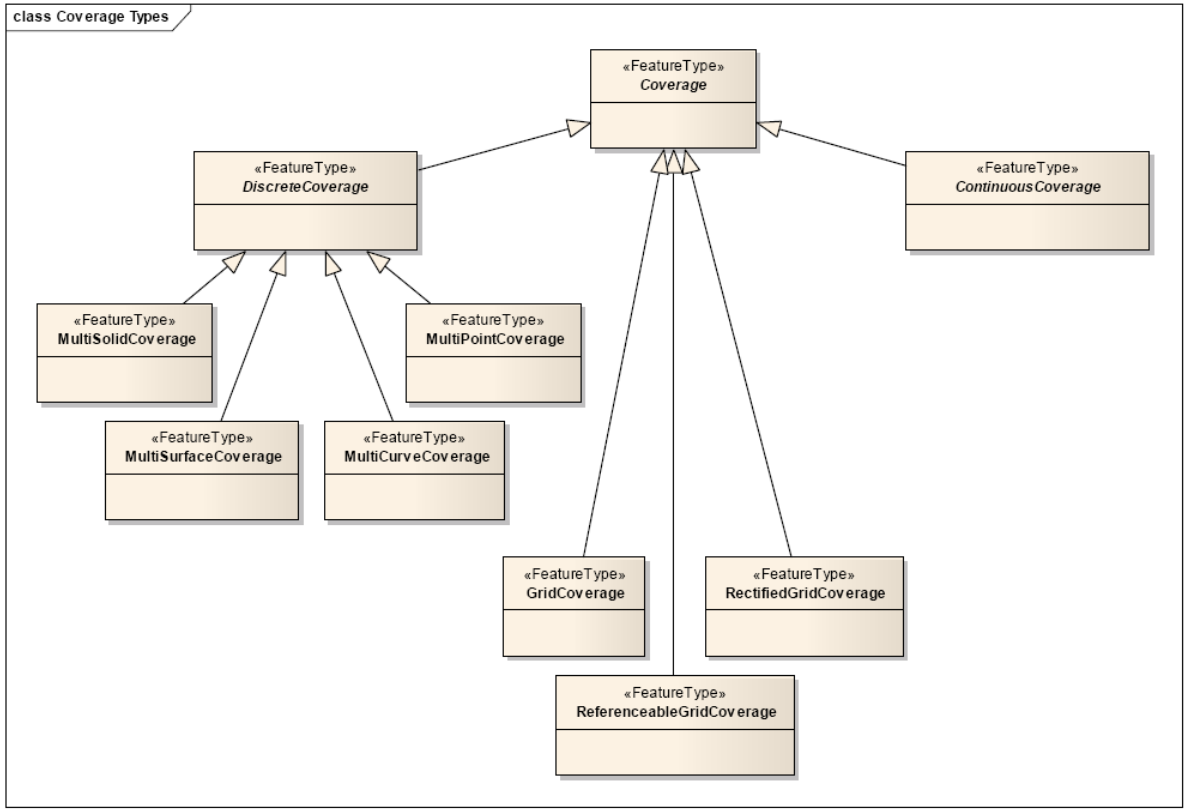
- CoverageFunction has been moved to Coverages;
  - Allows to create Functions for Discrete and Continuous Coverages



Source : [OGC 09-146 GMLCOV GML Application Schema - Coverages]

GMLCOV Apllication Schema

- Grid Coverages are type of Coverages instead of Discrete Coverages.
- "*This allows representing not only discrete grid coverages, but also continuous coverages by using grids for the reference points in conjunction with a coverage function defining interpolation.*"

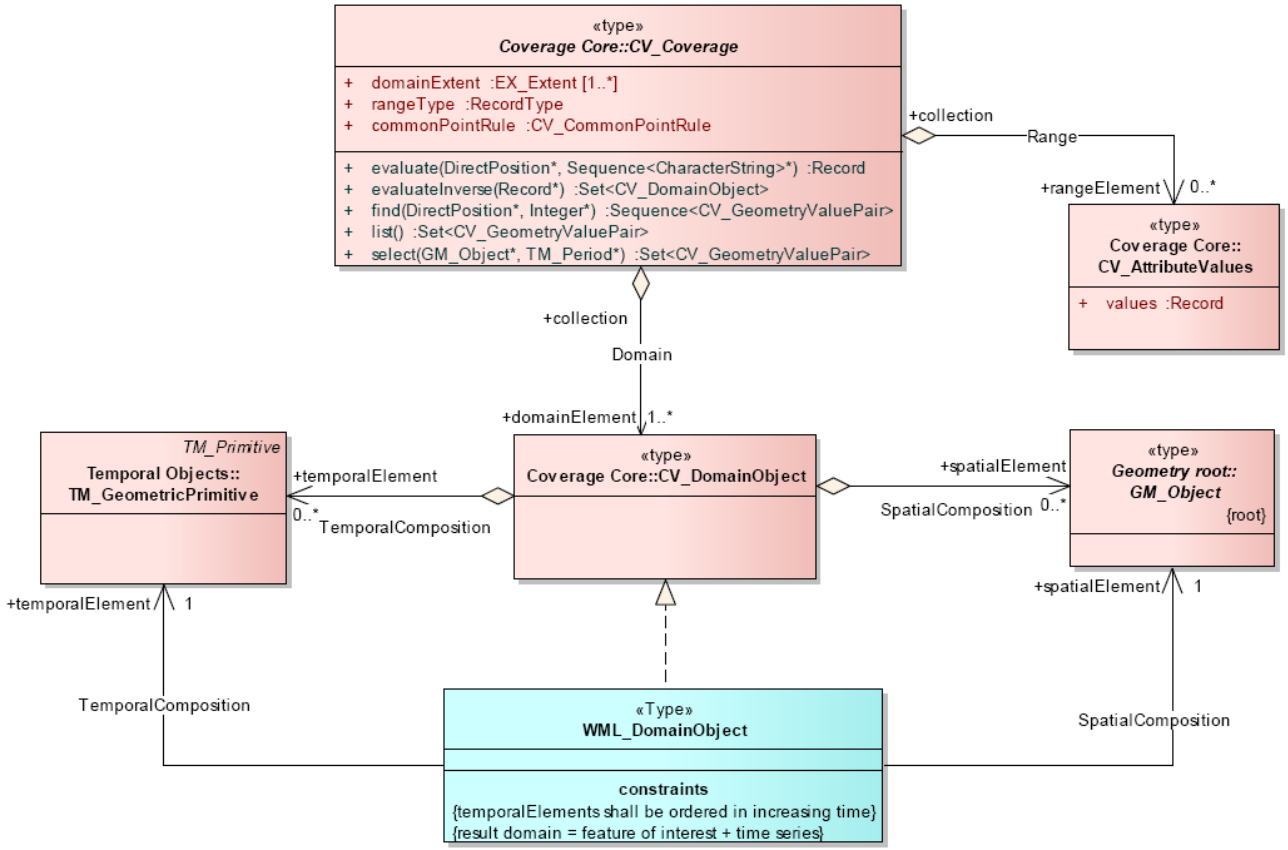


Source : [OGC 09-146 GMLCOV GML Application Schema - Coverages]

Interpolation in WaterML 2.0

WaterML 2.0 – Timeseries as Coverage

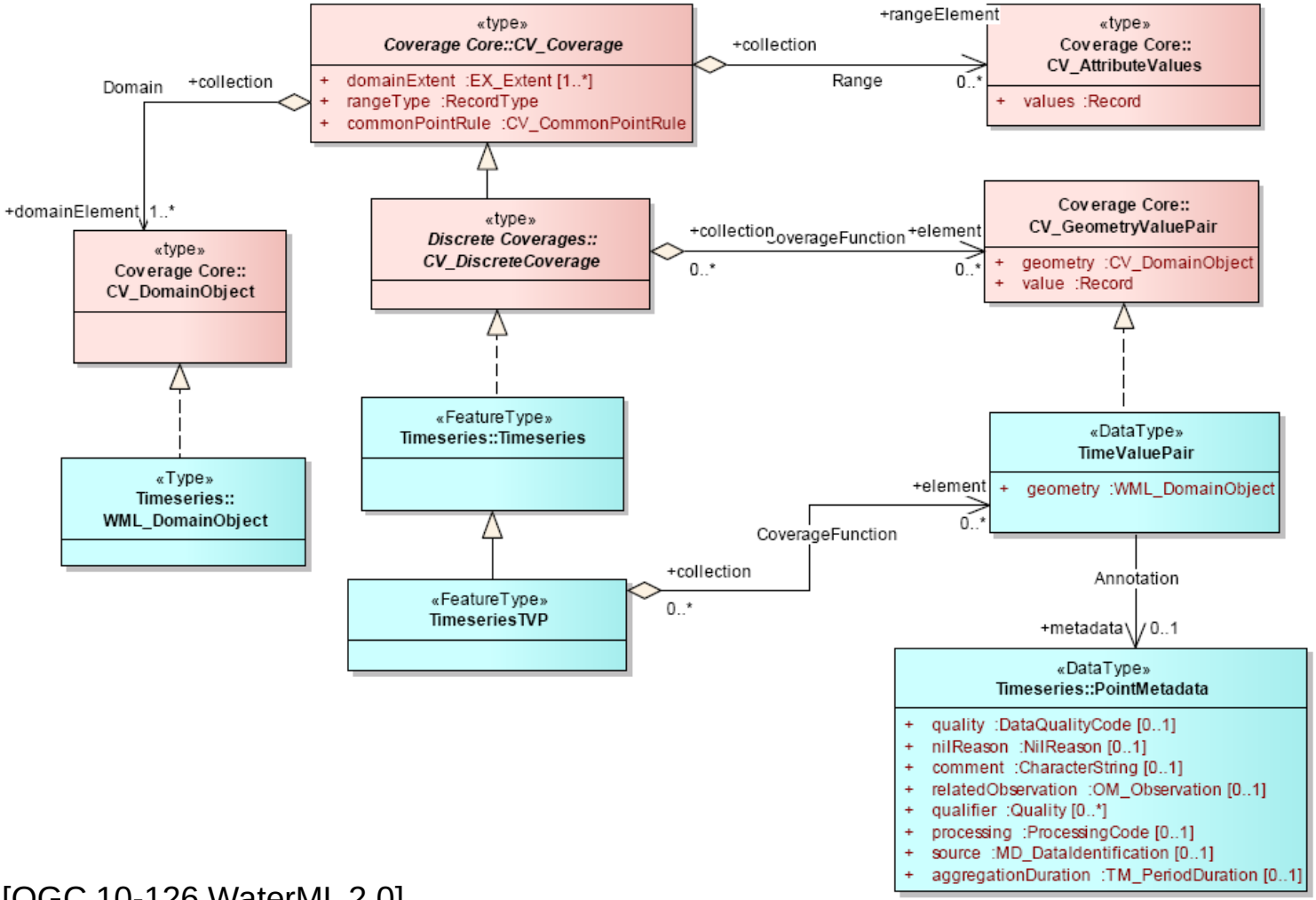
- *"WaterML2.0 defines a timeseries as a coverage whose domain consists of collection of ordered temporal elements and the spatial component relates to the feature of interest of the observation."*



Source : [OGC 10-126 WaterML 2.0]

WaterML 2.0 – Timeseries as Coverage

- Extension of only Discrete Coverages; Continuous Coverages are not supported



Source : [OGC 10-126 WaterML 2.0]

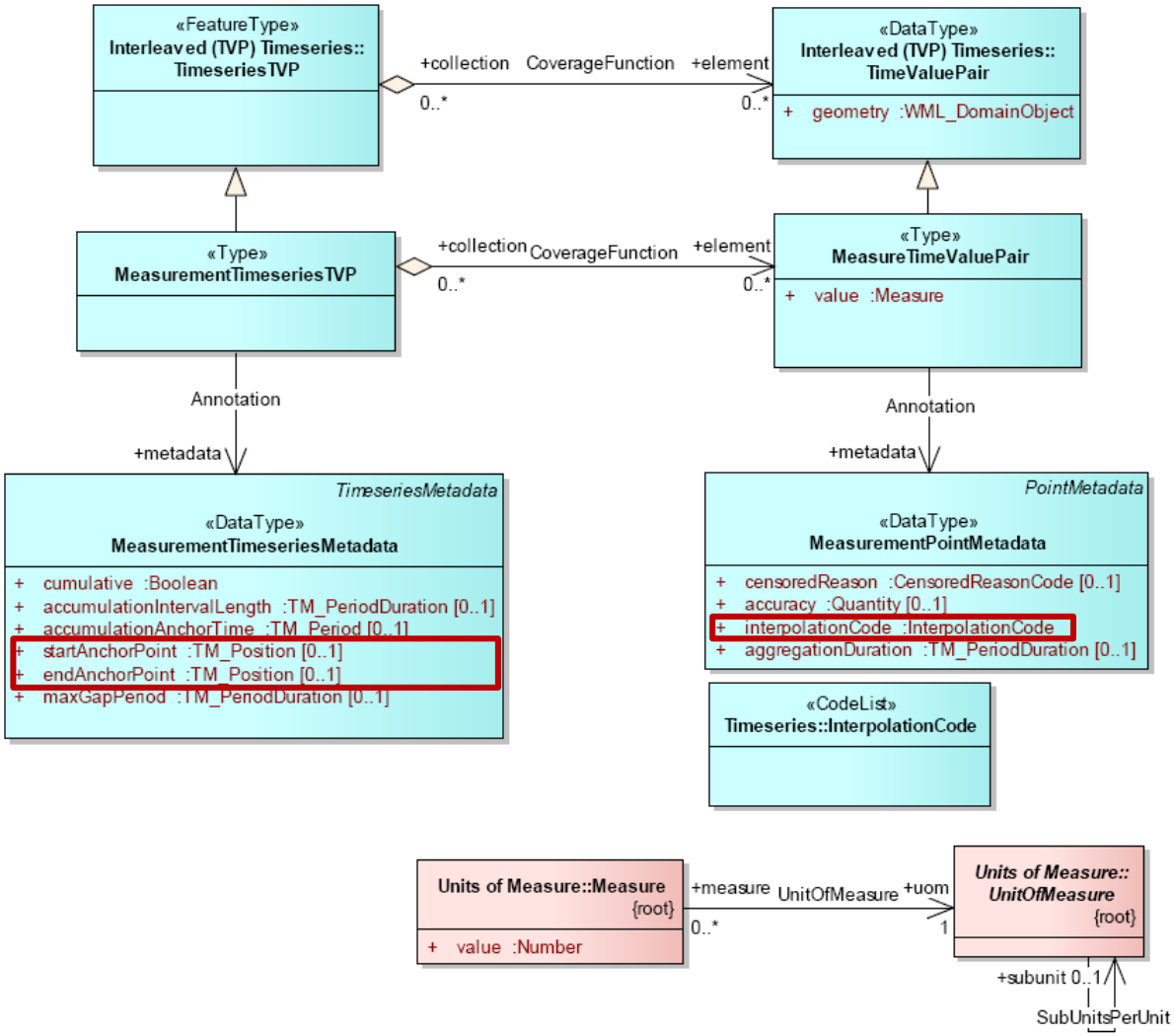
Timeseries in WaterML 2.0

- Two sub-classes of Timeseries:

- Measurement Timeseries
  - All values of the time-value pair or the ranges in domain-range are of type measure
  - Always associated to a unit of measure
  - Unit of measure is same throughout the timeseries

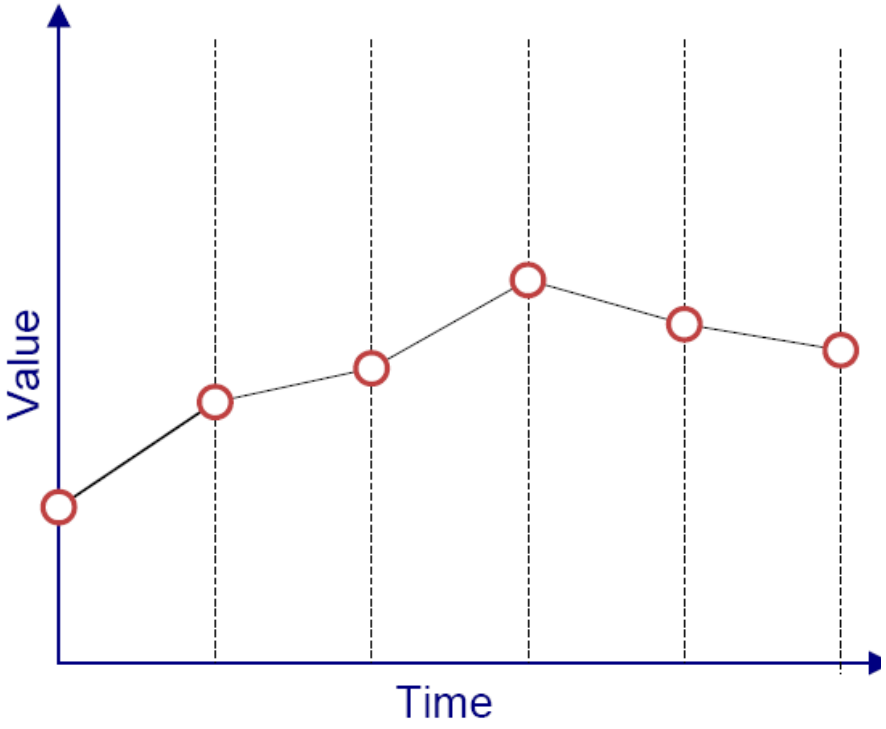
- Categorical Timeseries
  - All values of the time-value pair or the ranges in domain-range are of type category

Measurement Timeseries

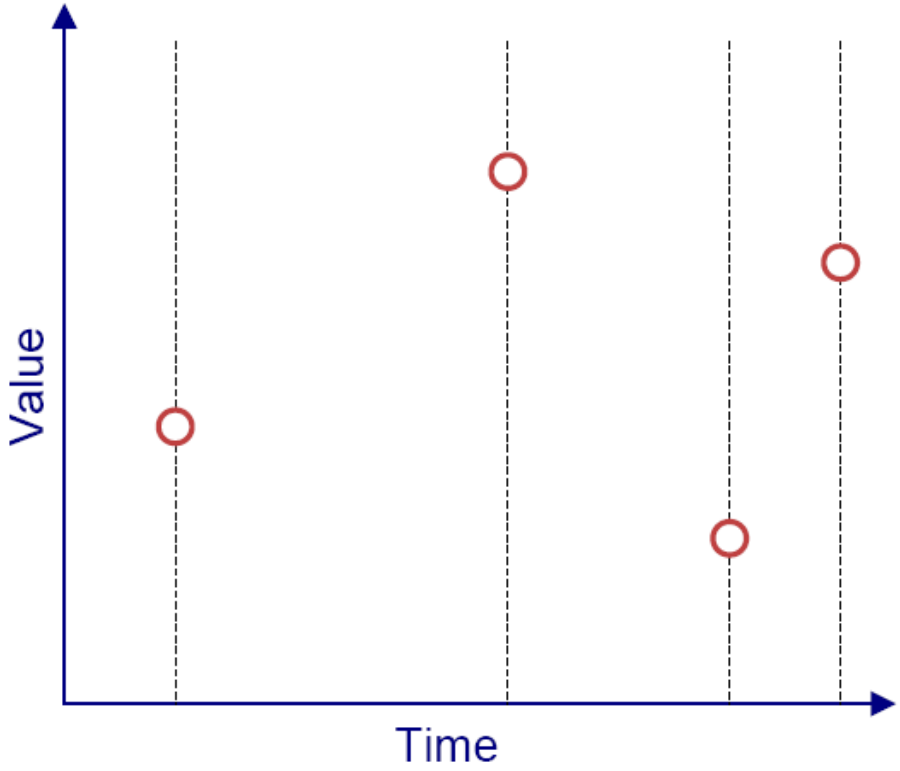


Source : [OGC 10-126 WaterML 2.0]

Interpolation Types



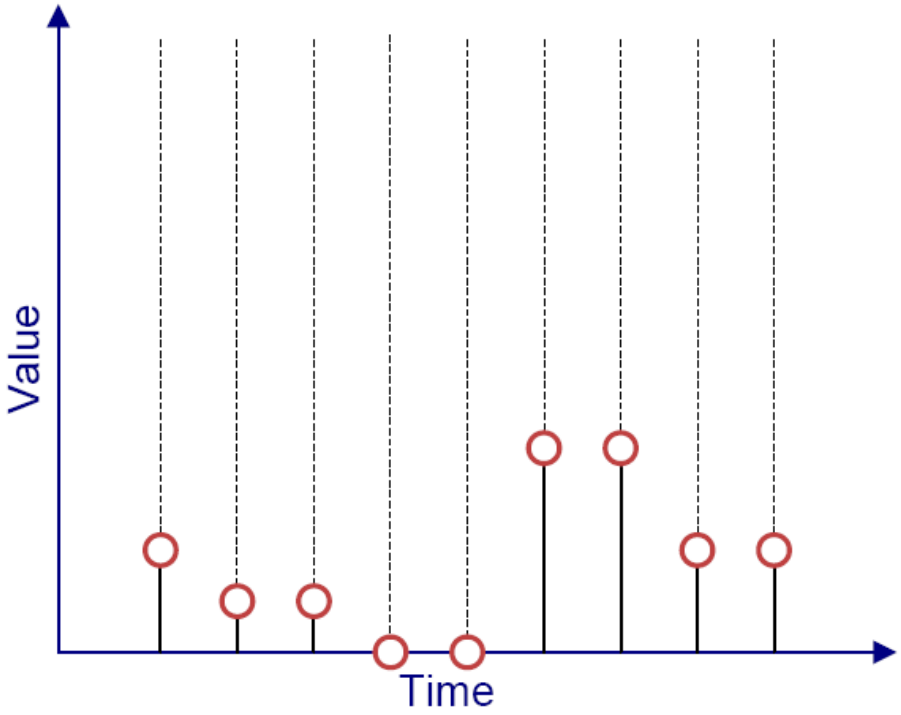
Continuous



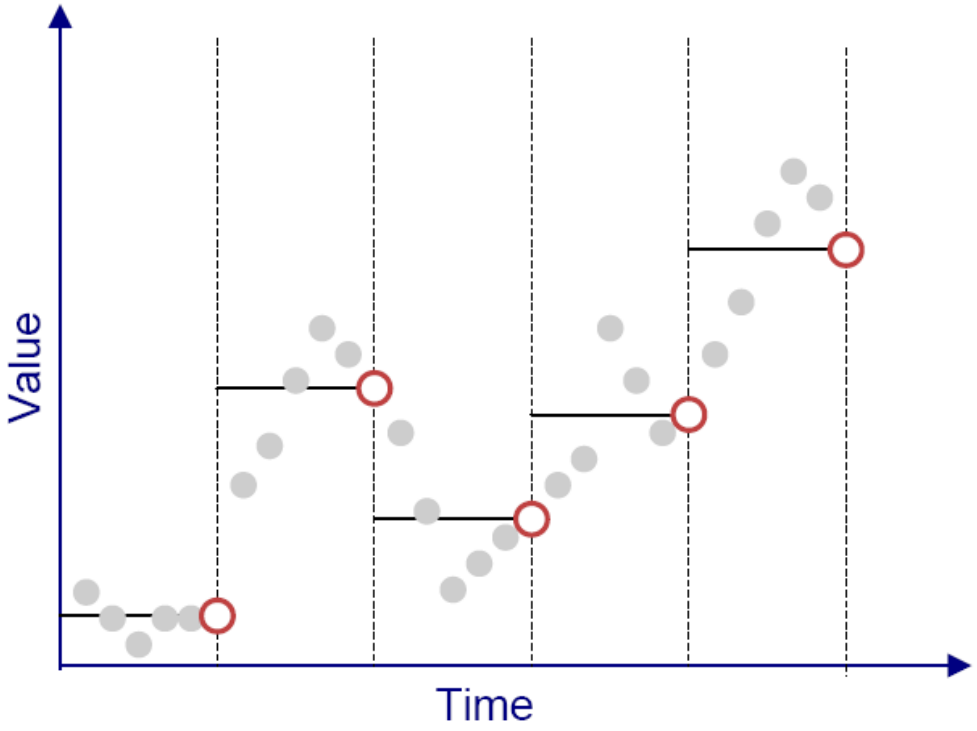
Discontinuous

Source : [OGC 10-126 WaterML 2.0]

Interpolation Types



Instantaneous Total



Step Functions

Source : [OGC 10-126 WaterML 2.0]

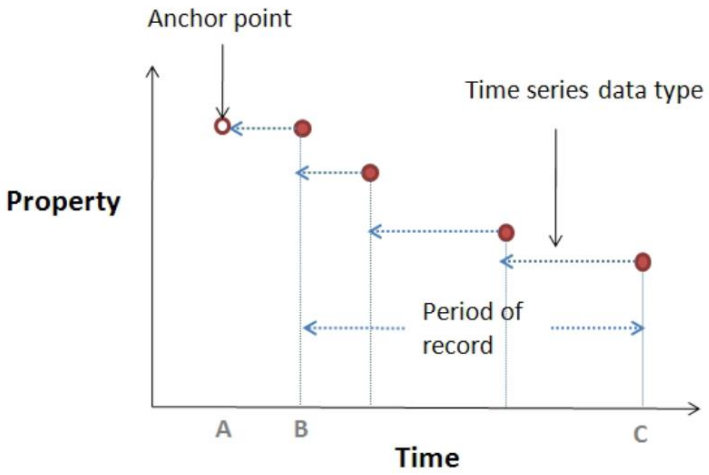
Conclusion

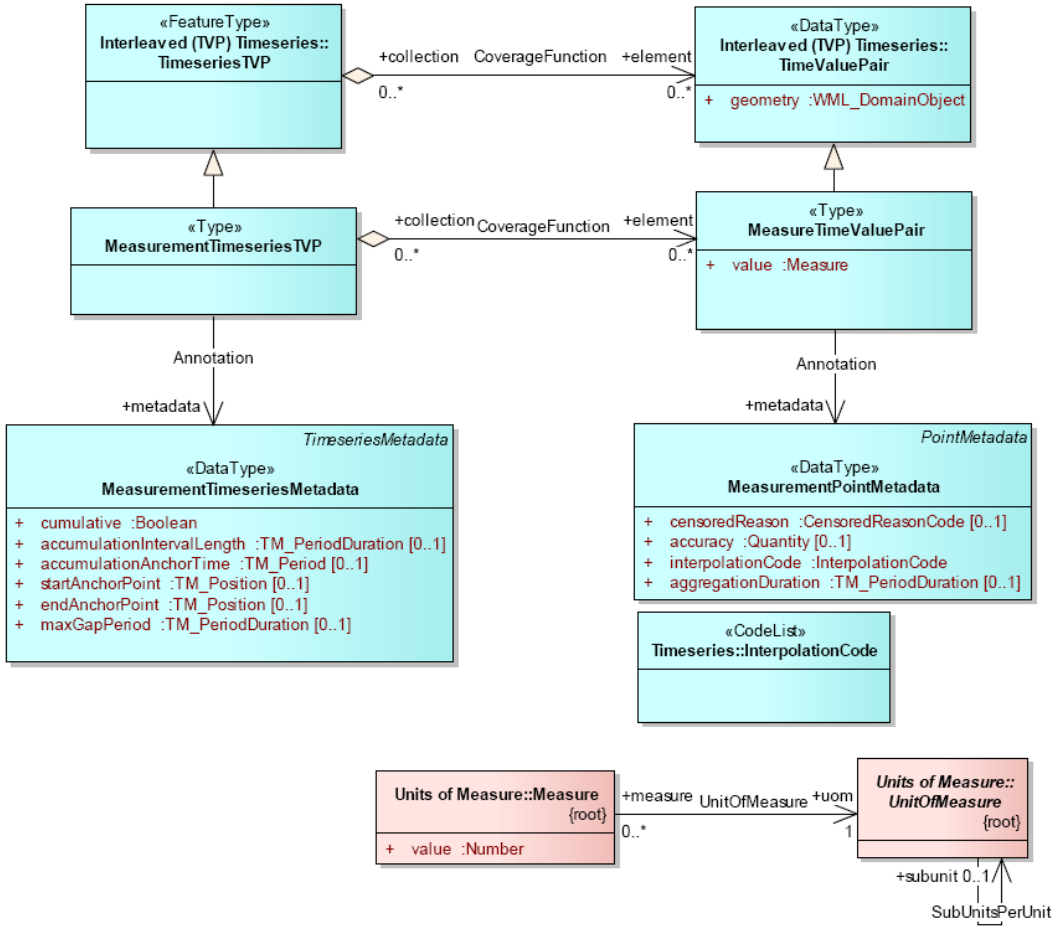
- ISO19123 CV_ContinuousCoverages may allow to define continuous coverages
  - The different types of interpolations can be defined within Coverage Function
  - Under reconsideration and not supported by GML or WaterML
- WaterML2.0 uses Discrete Coverages and allows to define interpolation types for each point in timeseries
- Should we define interpolation within coverage function or for each point in CityGML 3.0?

Patterns

Patterns

- Anchor Points within WaterML2.0 define (starting points) of the period of times for whch the observations are valid

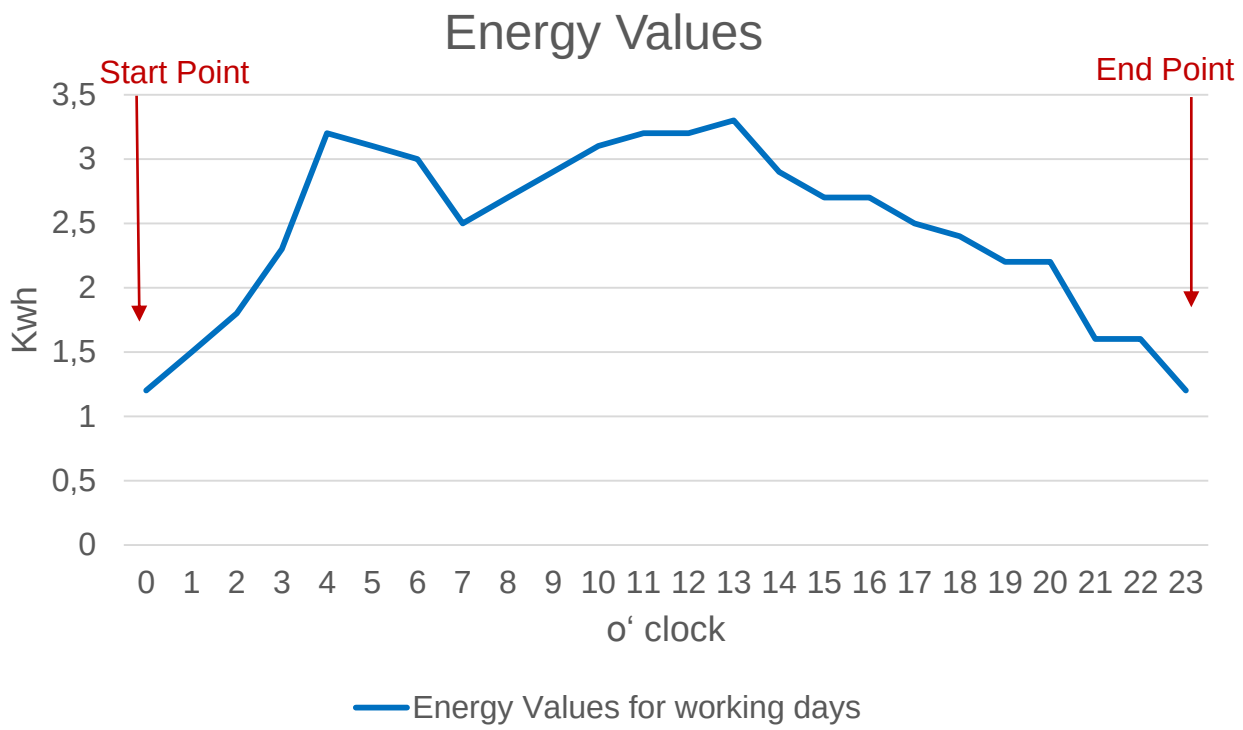




Source : [OGC 10-126 WaterML 2.0]

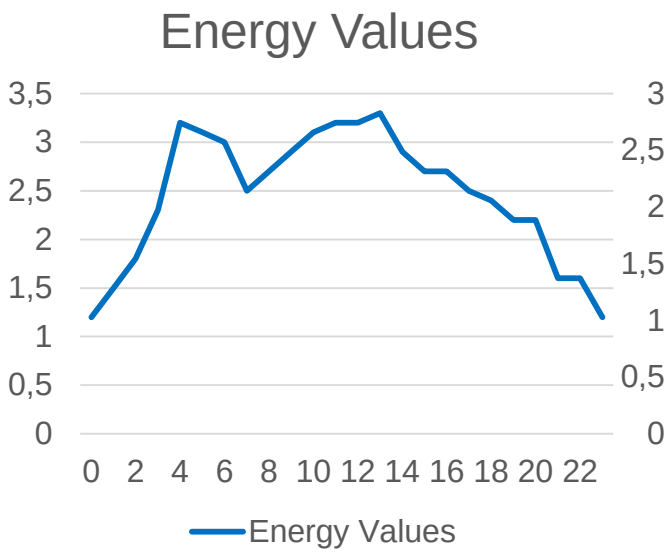
Pattern

- WaterML2.0 defines directional timeseries (e.g. variation of energy values according to a day)
- Pattern can be defined facilitating start and end points with an incrementor value

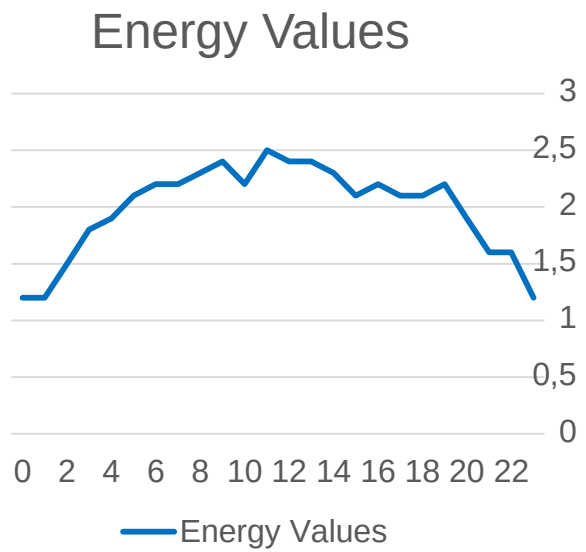


Pattern

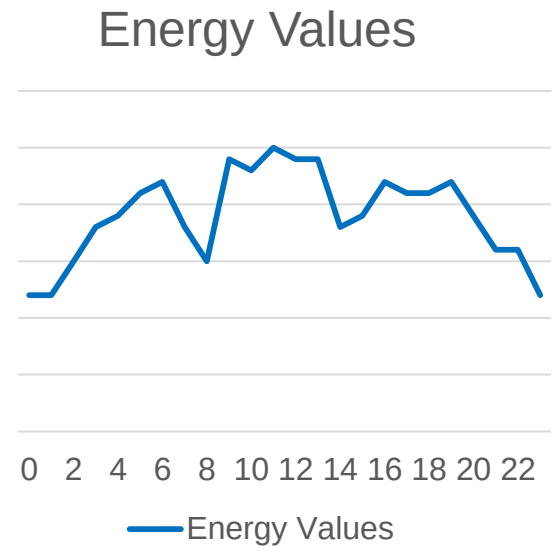
- In this way, each pattern can consist of sequence of different timeseries



Pattern 1
(Working days)



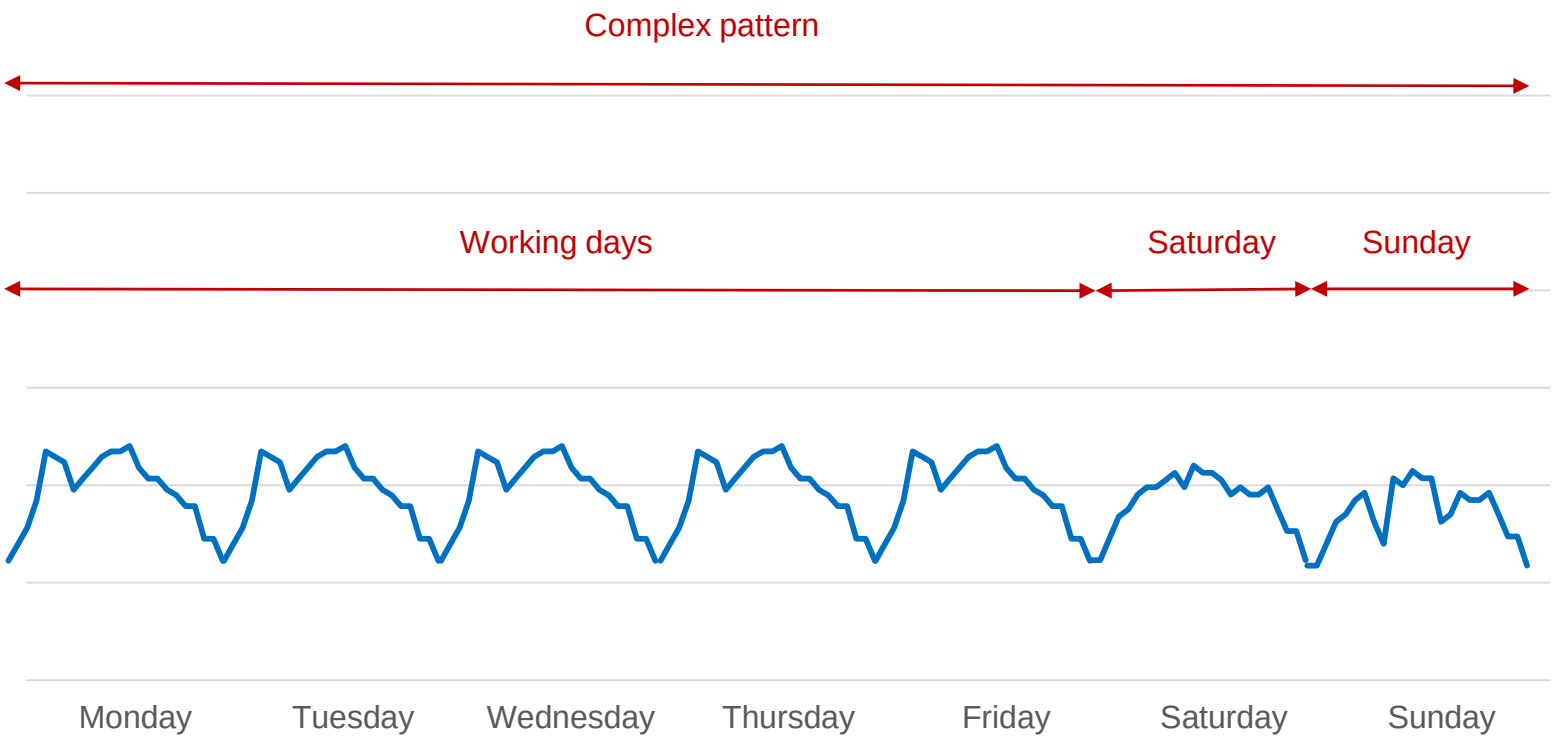
Pattern 2
(Saturdays)



Pattern 3
(Sundays)

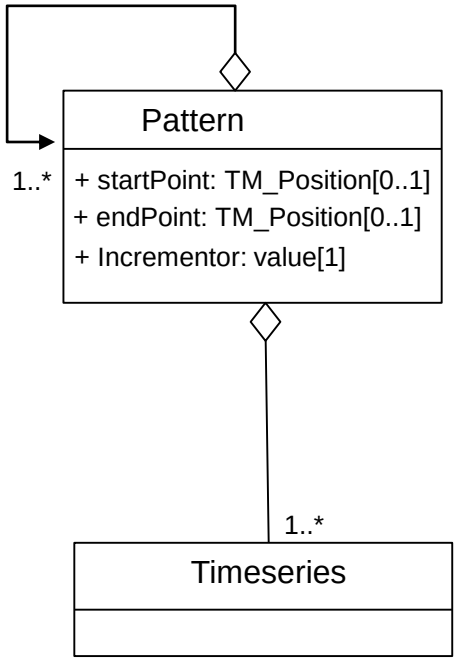
Complex Patterns

- Energy demand estimations may require separate patterns for weekdays and weekends
- Can be defined by nested patterns

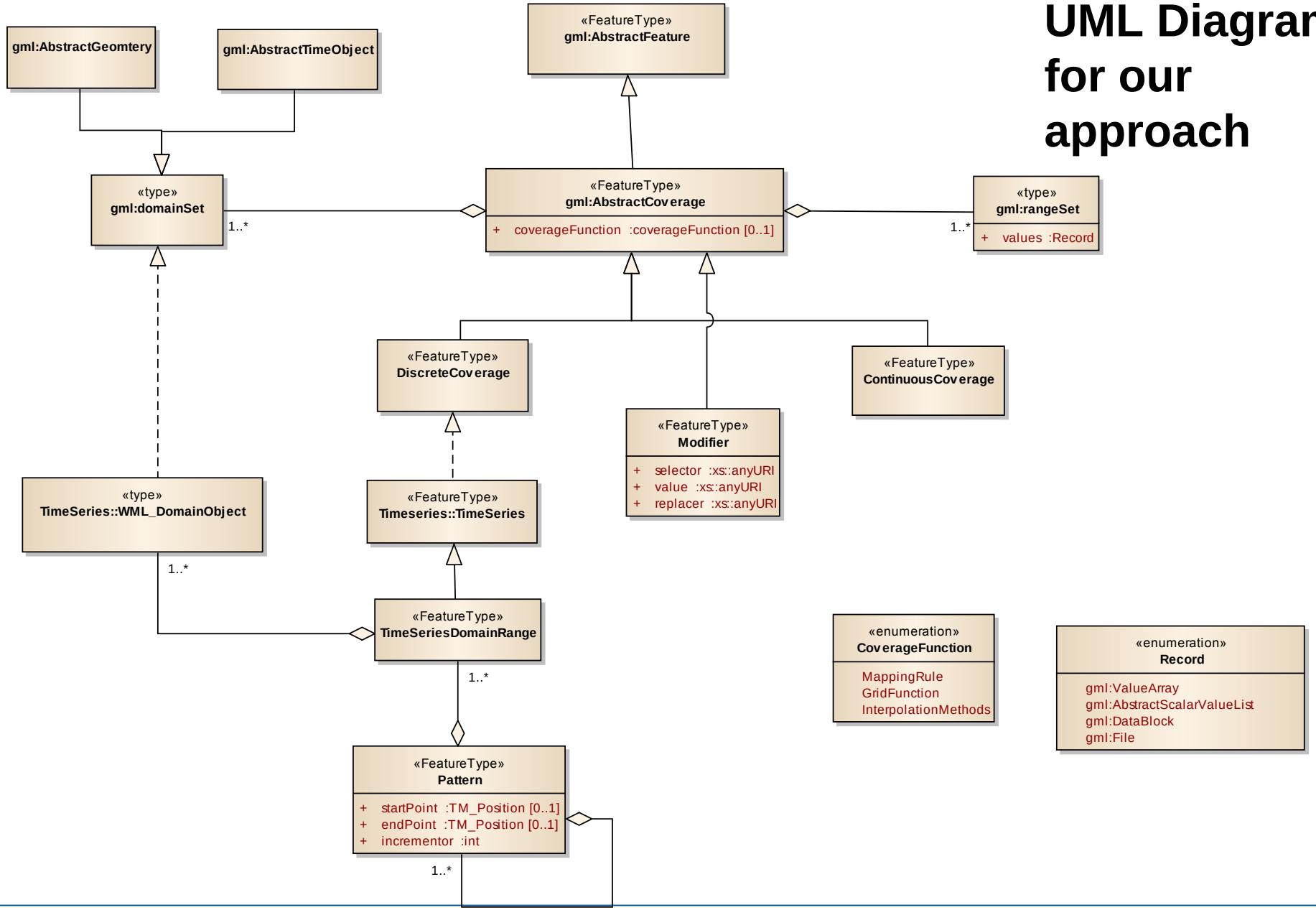


Patterns

- Can be defined as a class, having
  - A start point
  - An end point
  - Incrementor value for time
- A pattern can consist of a sequence of different timeseries
- Each pattern can consist of multiple patterns (nested patterns)



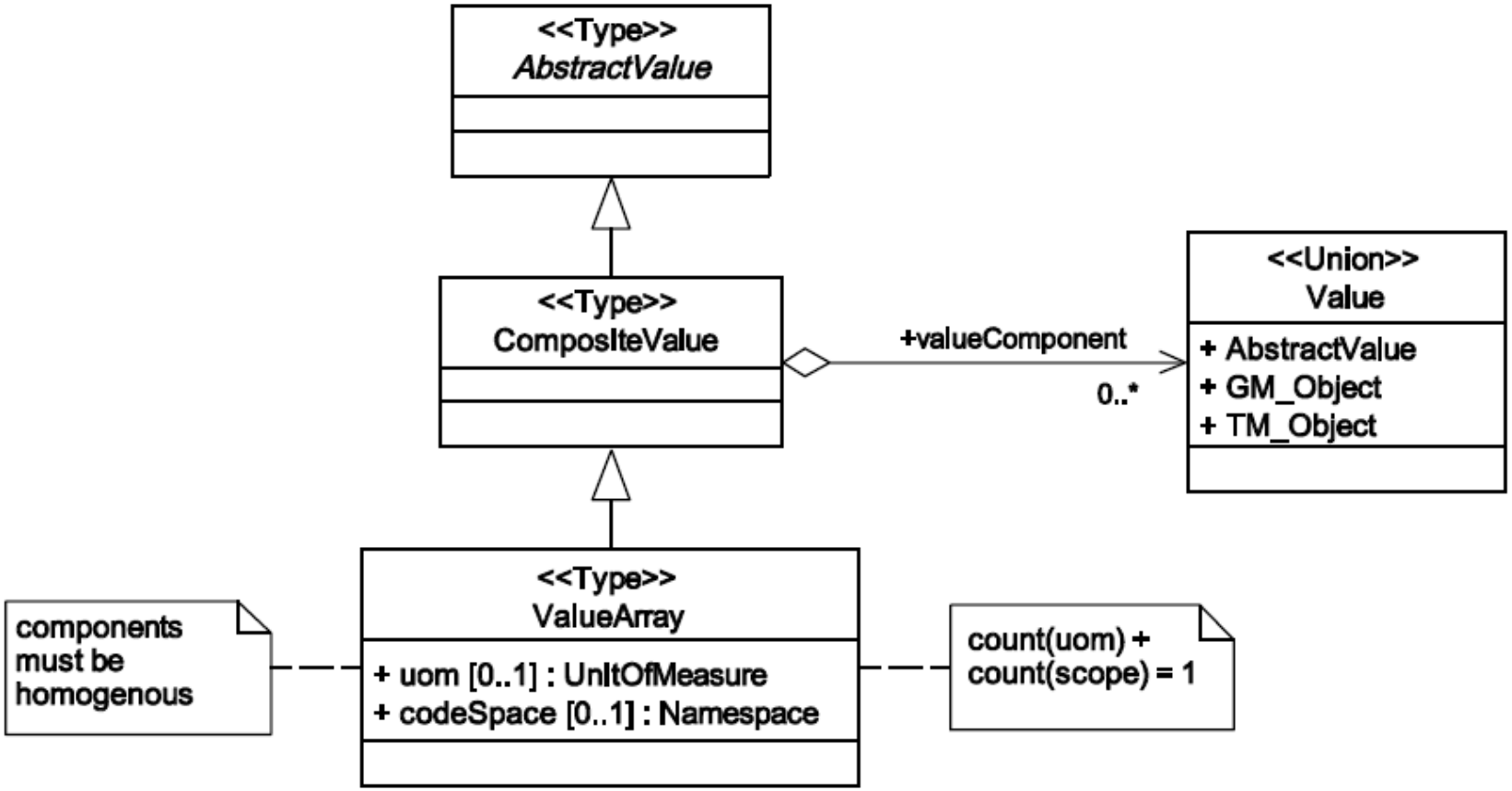
UML Diagram for our approach



Geometries in Range

- Question: Is it possible to support geometries within range set? That would be helpful for the support of Moving Objects
- Gml:ValueArray (already supported as Range type)
  - Used for homogeneous arrays of primitive and aggregation values
  - The value members maybe scalars, composites, arrays or lists
  - Contains gml:valueComponent that refers to, or, contains a Value, which can be
    - Gml:AbstractValue
    - Gml:AbstractGeometry
    - Gml:AbstractTimeObject
    - Gml:Null
- Hence, it is possible to support geomtries within range set.

Geometries in Range



Source : [OGC 07-036 GML Encoding Standard]