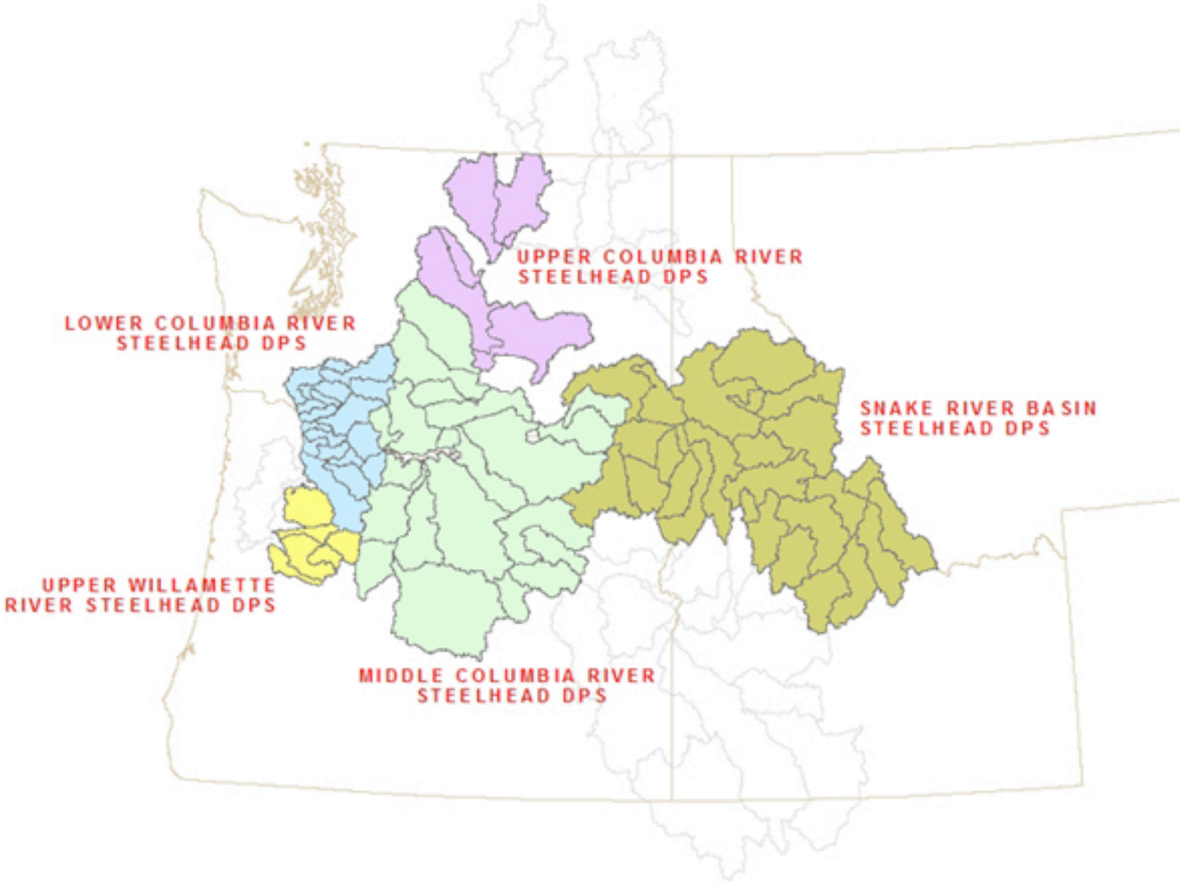
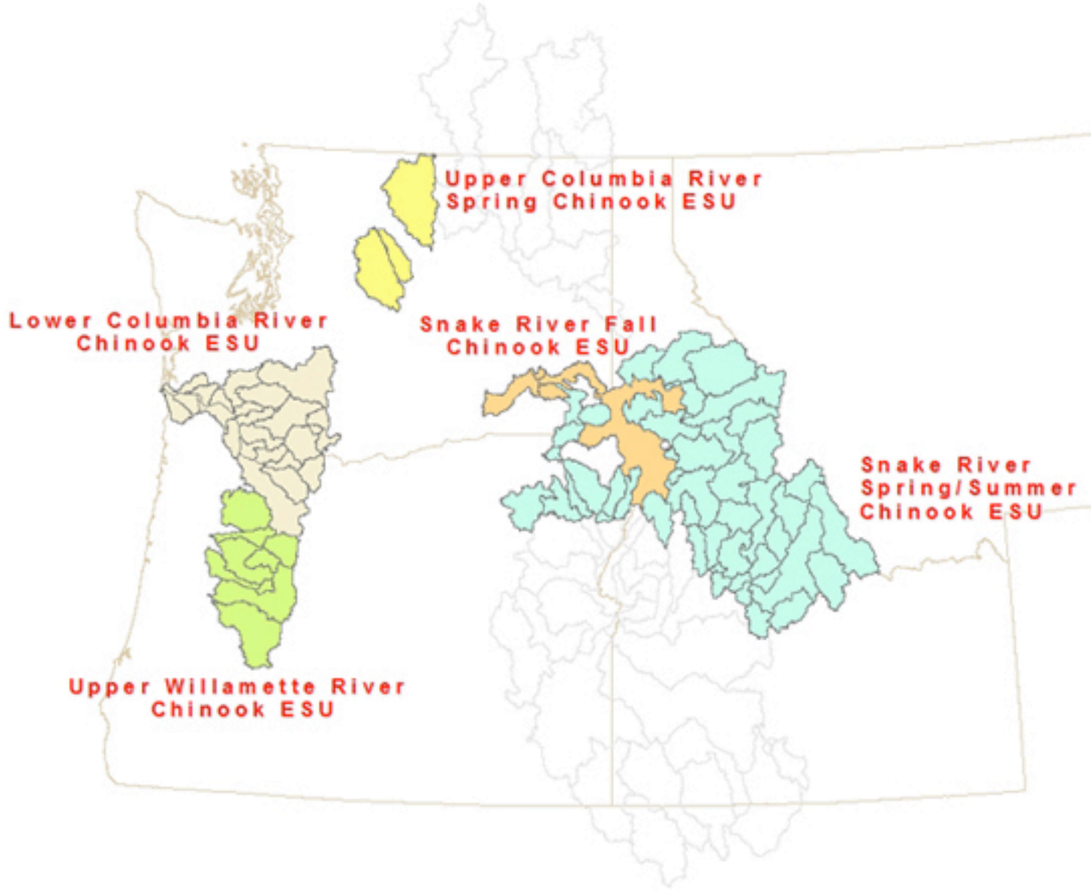
OBOE Space And Time

- Ontology extensions need consistent classes for spatial and temporal concepts
- International standards provide low-level building blocks of these concepts
  - ISO, OGC, FGDC, etc.
- Domains are expected to create application schemas that incorporate these concepts into higher level concepts
- None provide OWL-based implementations
- NASA SWEET provides both, although less comprehensively

Example: Modeling Salmonid ESUs

- **Evolutionarily Significant Units: subspecies populations from given geographic locations and seasonal runs designated as genetically distinct**





Comparison Of Standards

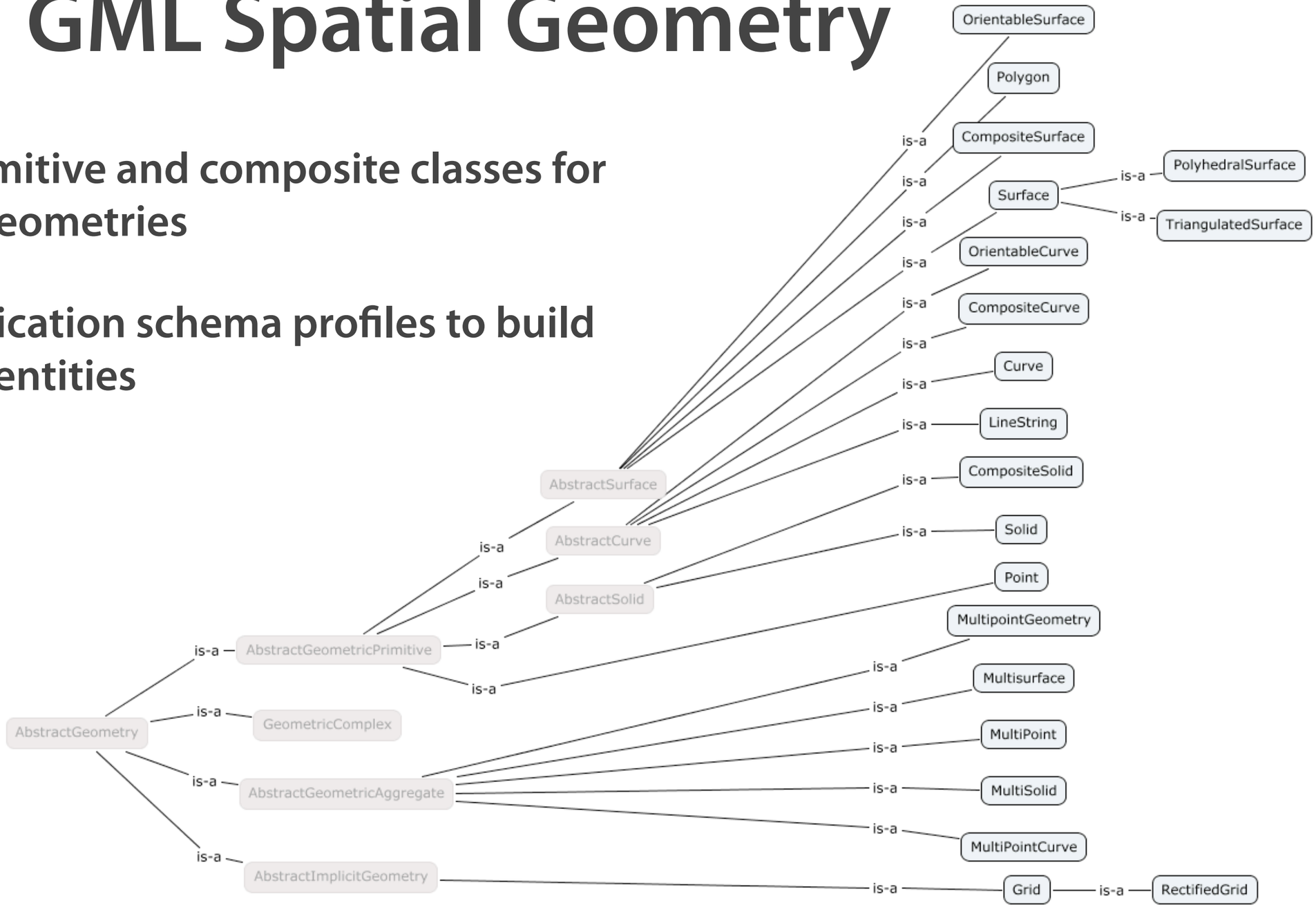
- The following slides provide a high-level look at spatial and temporal concepts in GML and SWEET
  - What level of abstraction is needed for OBOE extensions?
  - Pros and Cons for SWEET vs GML concept adoption

GML Spatial Components

- Underlying Models: Profile of ISO 19107, 19111
  - Spatial Geometry
  - Spatial Topology
  - Spatial Reference Systems
  - Spatial Datums
  - Spatial characteristics of geographic data

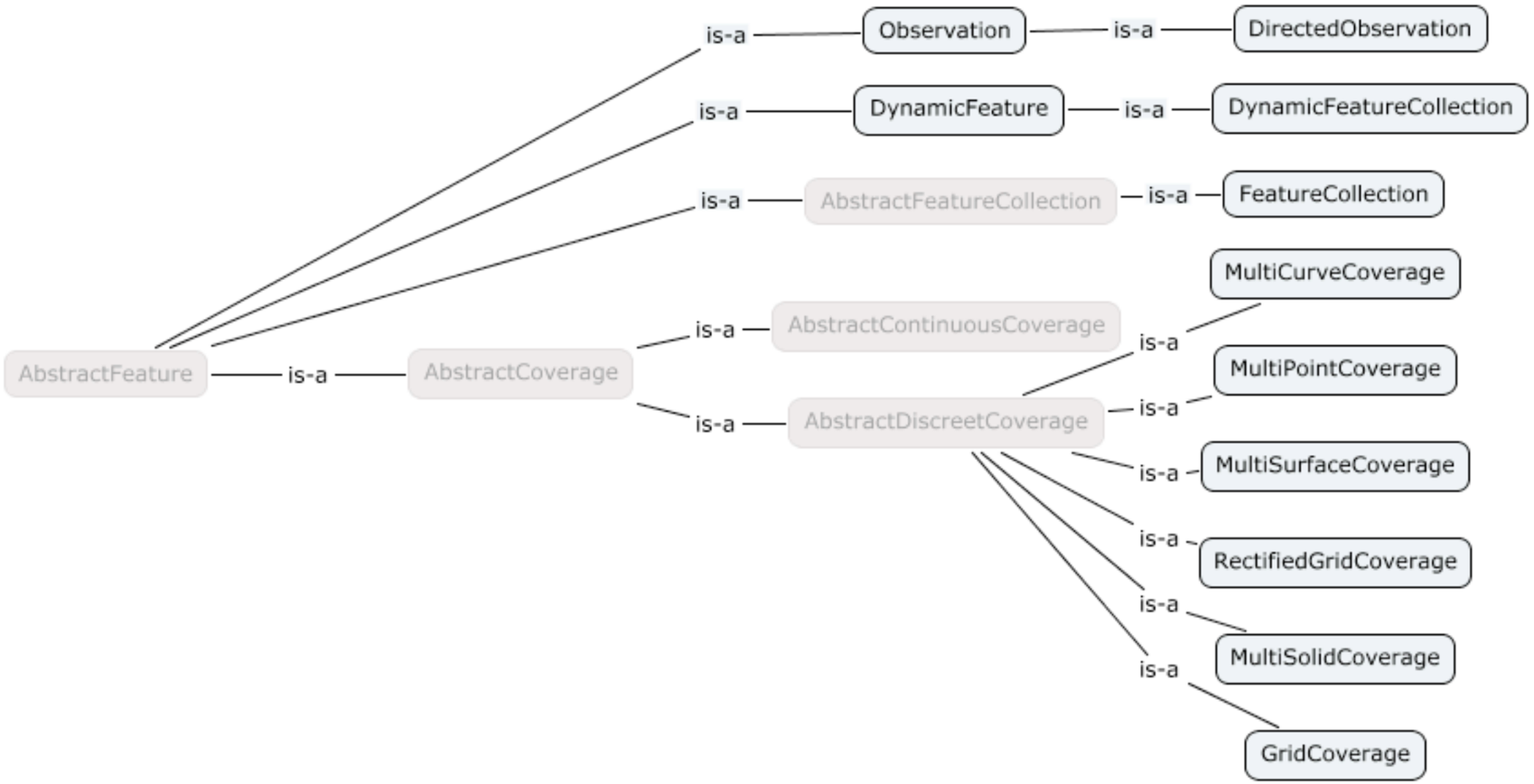
GML Spatial Geometry

- Provides primitive and composite classes for describing geometries
- Used in application schema profiles to build higher level entities



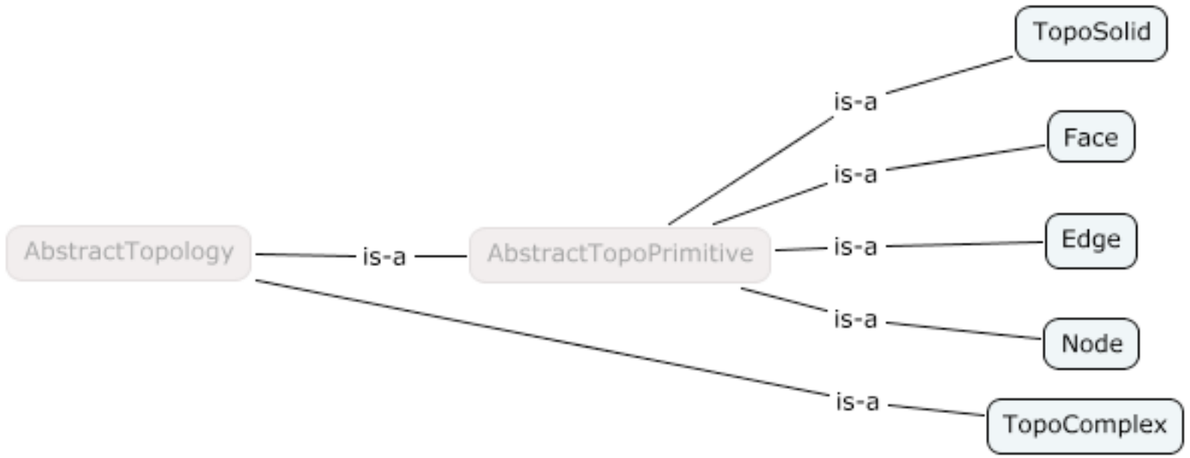
GML Features

- **Real world phenomena perceived in the context of a geographic application and classified into types that define instances**



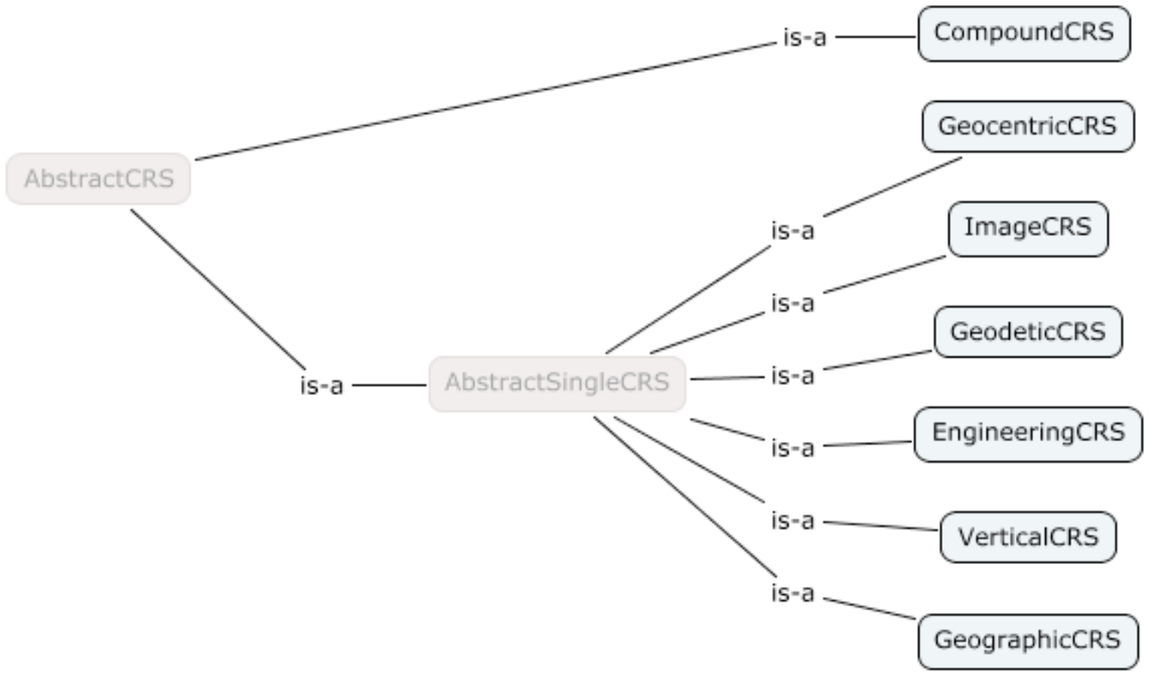
GML Spatial Topology

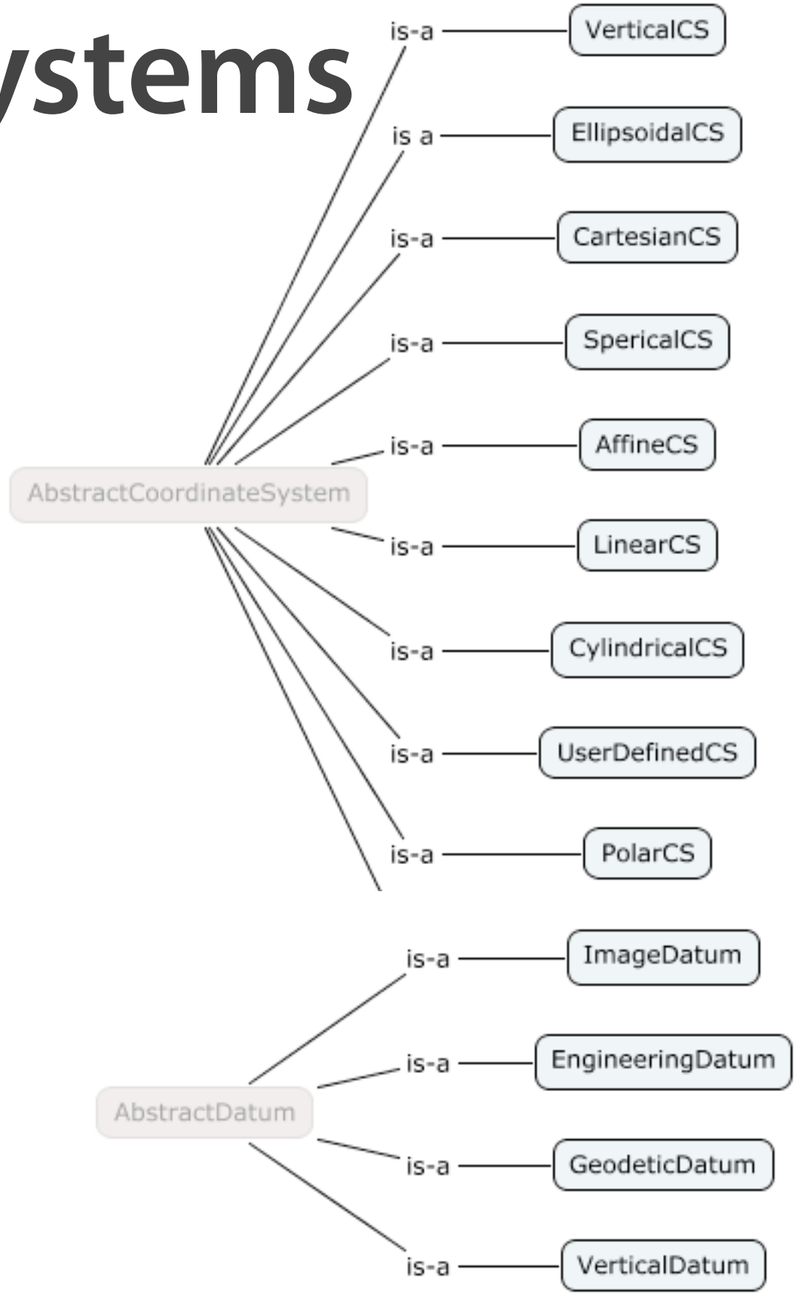
- Allows characterization of the spatial relationships between objects using simple algorithms
- Allows a mechanism for expressing shared geometry among geographic features



GML Spatial Reference Systems

- Provide a framework for interpreting features in relation to an Earth geoid approximation
- Each single Coordinate Reference System includes one datum and one coordinate system





GML Temporal Components

- **Underlying Model: Profile of ISO 19108**
  - **Temporal Geometry**
  - **Temporal Topology**
  - **Temporal Reference Systems**
  - **Temporal characteristics of geographic data**

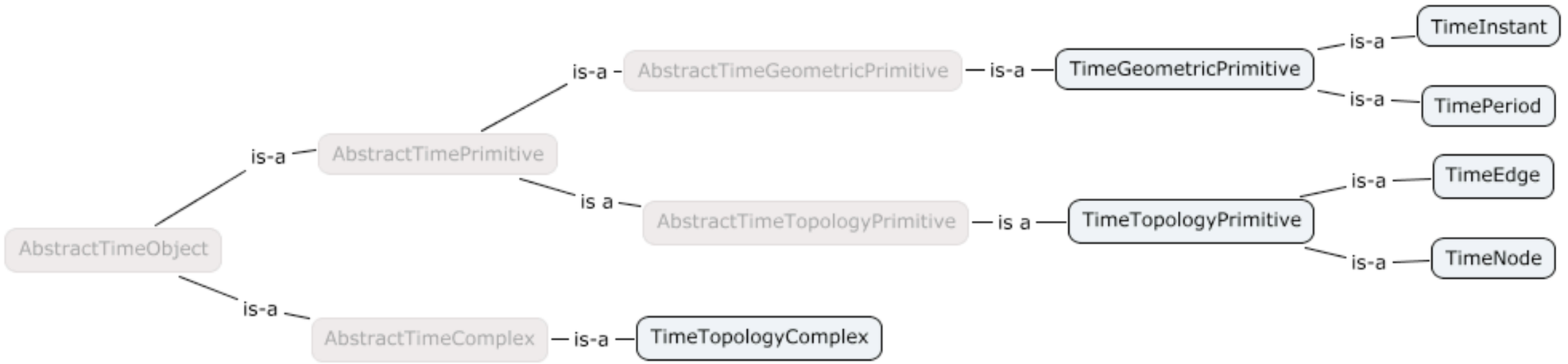
GML Time

- Time is measured on two types of scale: interval and ordinal. An interval scale offers a basis for measuring duration, an ordinal scale provides information only about relative position in time.

GML Temporal Geometry & Topology

- Temporal geometry is described in terms of time instants, periods, positions and lengths.

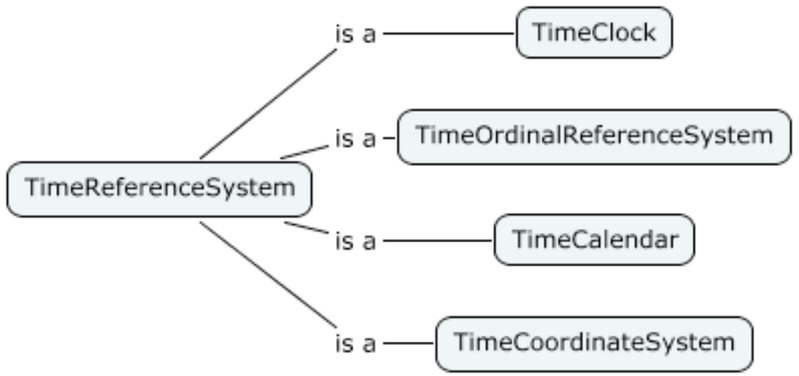
- Temporal topology is described in terms of time complexes, nodes, and edges, and the connectivity between these



GML Temporal Reference Systems

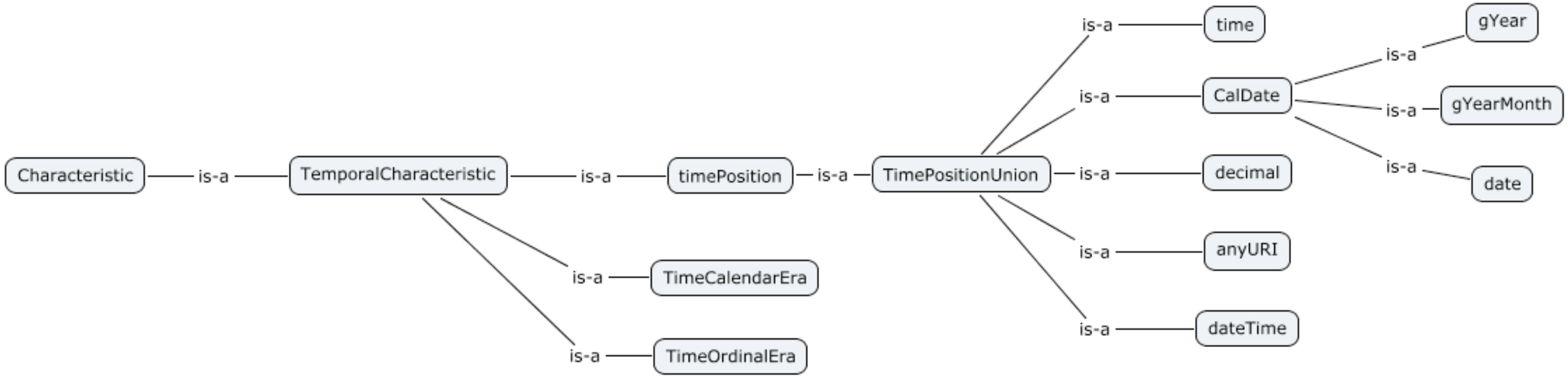
- A value in the time domain is measured relative to a temporal reference system.

- Common types of reference system include calendars, ordinal temporal reference systems, and temporal coordinate systems



GML Temporal Characteristics

- Values based on calendars and clocks use lexical formats that are based on ISO 8601
- A decimal value may be used with coordinate systems such as GPS time or UNIX time
- A URI may be used to provide a reference to some era in an ordinal

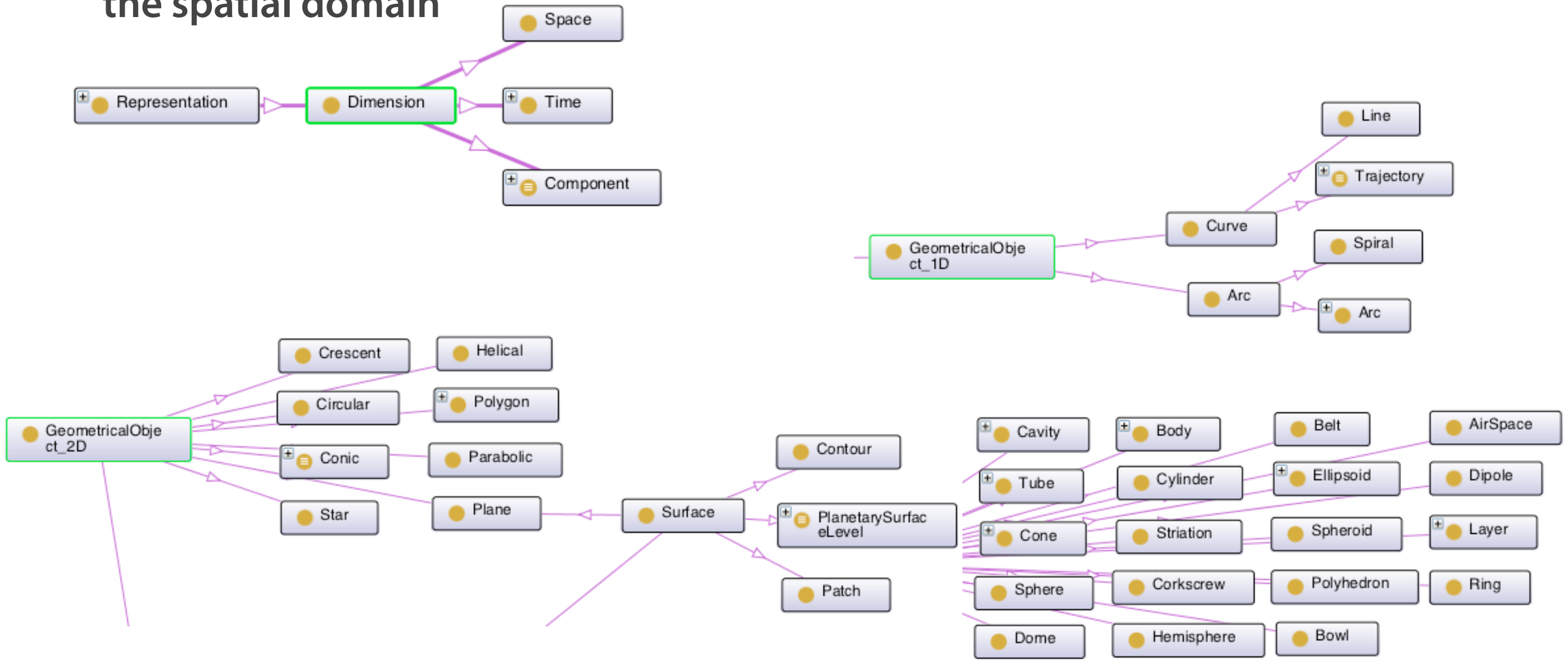


SWEET Ontologies

- Organized into faceted and integrative ontologies
- Faceted ontologies take a reductionist approach, hierarchichally providing more detail with depth (Numerics, Time, Space, Units, Physical Properties ...)
- Integrative ontologies take a synthesis approach by using elements from the faceted ontologies (phenomena, human activities)
- Results in a highly connected ontology (can be difficult to interpret)
- Modeling of space and time is less consistent than GML/ISO

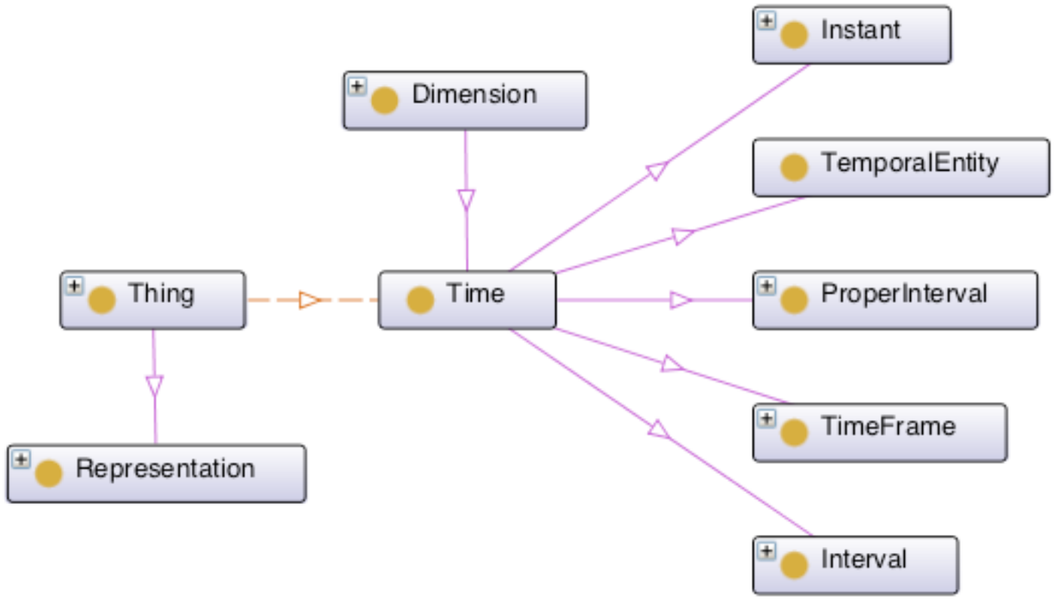
SWEET Spatial Components

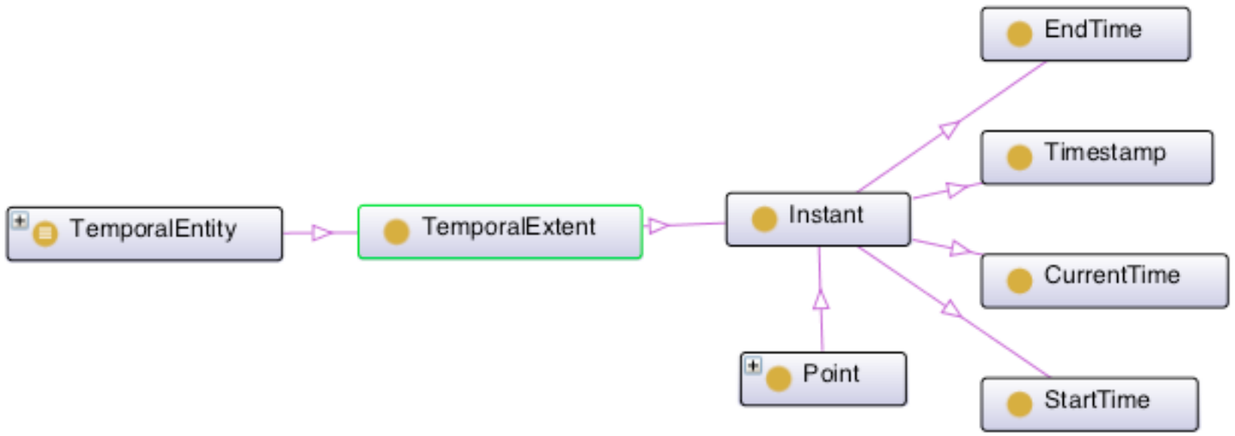
- Space is a multidimensional numerical scale with terminology specific to the spatial domain



SWEET Temporal Components

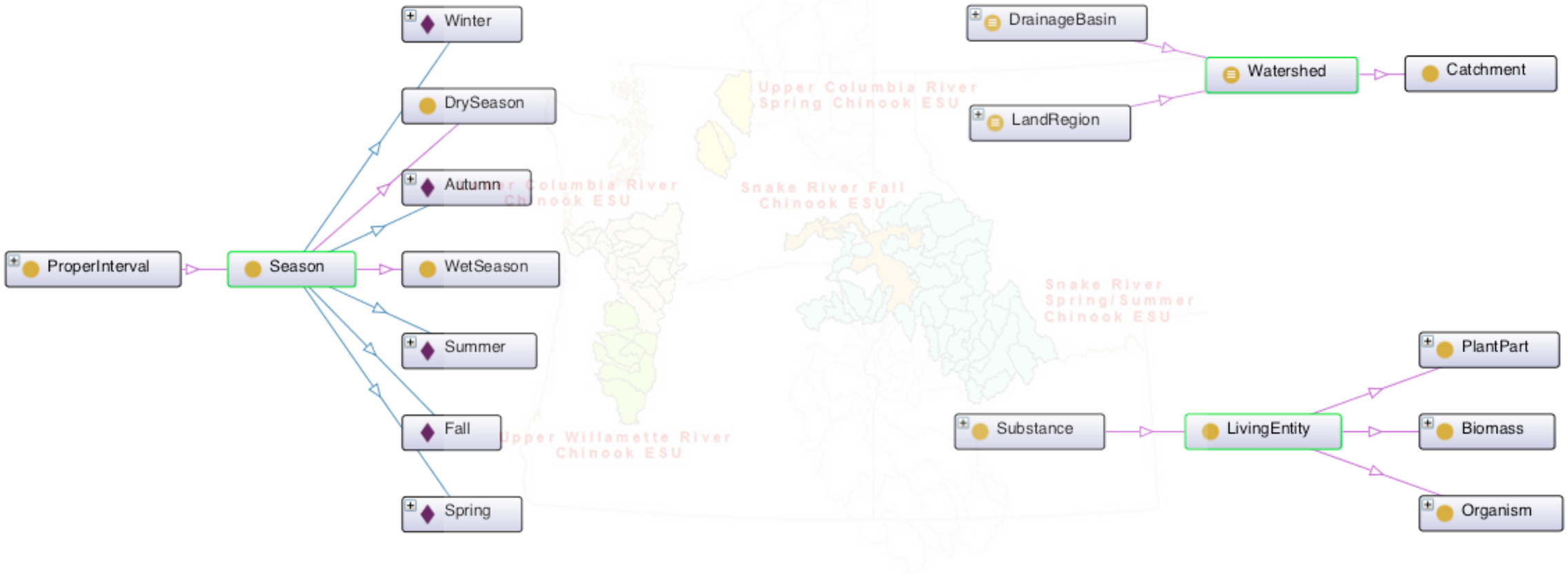
- Time is a numerical scale with terminology specific to the temporal domain
- Temporal extents and relations are special cases of numeric extents and relations
- Temporal extents include: duration, season, century, 1996, etc. Temporal relations include: after, before, etc.





SWEET Domain Concepts

- Provide higher-level environmental concepts
- WRT the ESU example, concepts of season (time), drainage basin (space), organism (species) are all provided



Questions

Which is more appropriate for integration into OBOE extensions?

- **SWEET**
  - **More domain relevant**
  - **More complex relationships**
  - **Less consistent modeling**
  - **OWL syntax**
- **ISO/GML**
  - **Less domain relevant**
  - **Less complex relationships**
  - **More consistent modeling**
  - **XML Schema syntax**