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Opportunities of SEIS and SISE: Integrating
Environmental Knowledge in Europe
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An Holistic View of Coverage Model and Services for SISE-SEIS

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Outline

- ▶ Information Modeling Approach
- ▶ Coverage concept
- ▶ Harmonization model for Coverage and Feature views of information
- ▶ Conclusions

Information Modelling Approach

- ▶ Adopted by International programmes and initiatives
 - ▶ Global Monitoring Systems (GMES, GEOSS)
 - ▶ SDI (INSPIRE, NSDI)
- ▶ **Interoperability** and **metadata** are two key technologies in discovering and enabling access to usable information and processing resources for the environment
- ▶ Interoperability is achieved by
 - ▶ adopting a Service-Oriented Architecture (SOA) approach
 - ▶ applying international standards and best practices
 - ▶ ISO 19100, OGC specifications

Conceptual Gap

- ▶ The information modeling approach is novel to the environmental and earth science communities
- ▶ There are significant challenges in bridging the conceptual gap
- ▶ Valuable experiences in the geosciences and atmosphere/ocean
 - ▶ Example is represented by the OGC GALEON IE
 - ▶ To foster interoperability between data systems used by the traditional GIS community and those in the MeteoOcean community

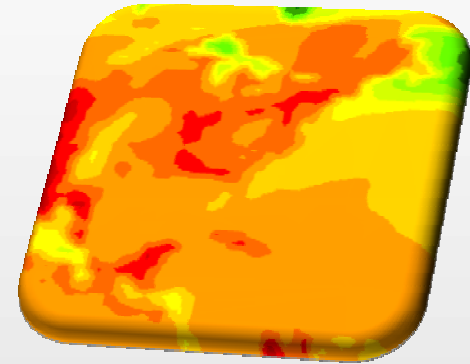
SISE (Single Information Space for the Environment) in Europe

- ▶ Important research challenges include
 - ▶ Holistic interdisciplinary approaches
 - ▶ Lack of common data models and semantics
- ▶ Geospatial information (ISO, OGC) modeling introduced two fundamental concepts to map discrete and continuous real world phenomena
 - ▶ Feature
 - ▶ Coverage
 - ▶ Feature subtype that has multiple values for each attribute type within the geometric representation of the feature

Coverage and Feature information Views

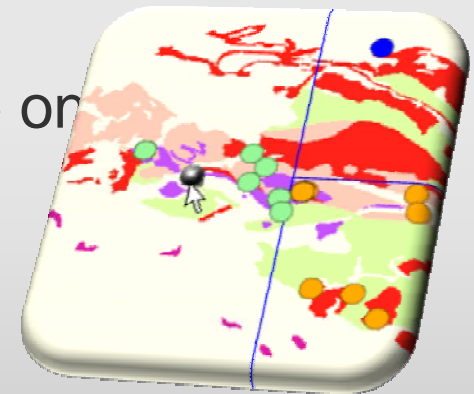
- ▶ A ‘coverage’ or field or direct-position view of information

- ▶ Geophysicists and “earth scientists” tend to work with physical properties, fields



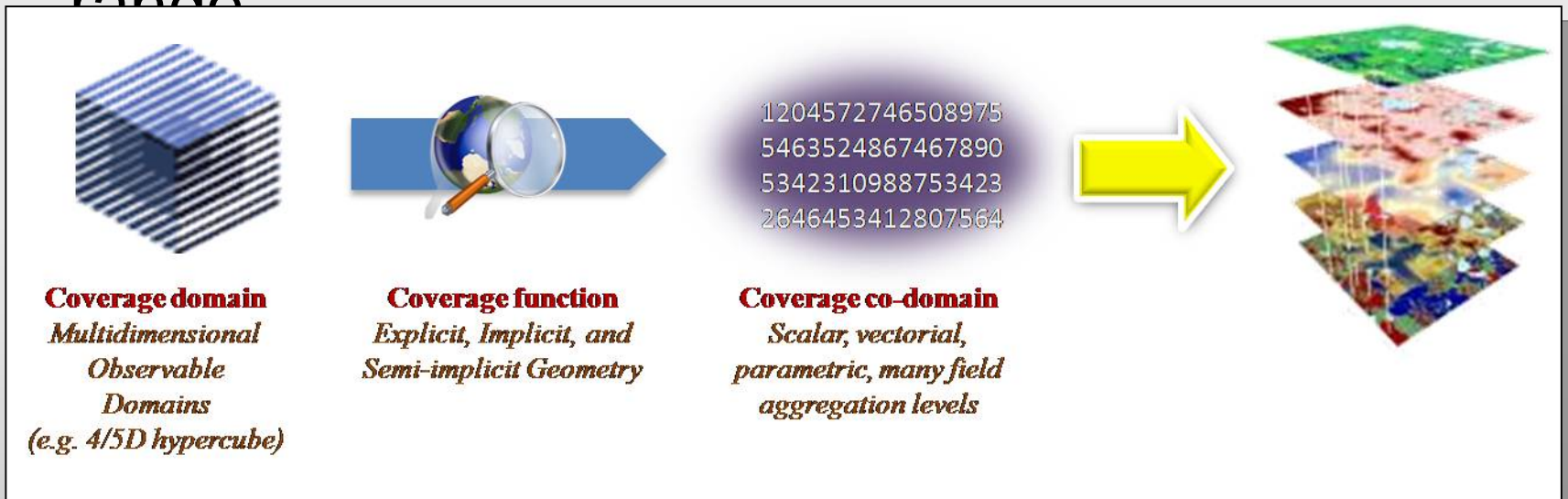
- ▶ A ‘feature’ or geo-relational or object view of information

- ▶ “Land managers” and Geologists focus more on entities, objects, features (discrete entities)



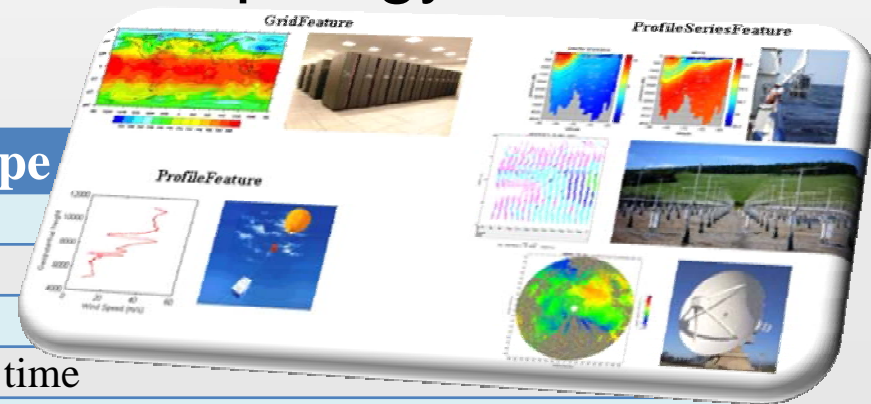
Coverage concept

- ▶ The “coverage” term refers to any data representation that assigns values directly to spatial position
- ▶ A coverage may be seen as a function from domain –spatiotemporal domain– to an attribute range



Coverage types

- ▶ Multiple coverage types exist
 - ▶ mainly, they are disciplinary related
- ▶ Classification by geometry and topology of the discrete coverage domain

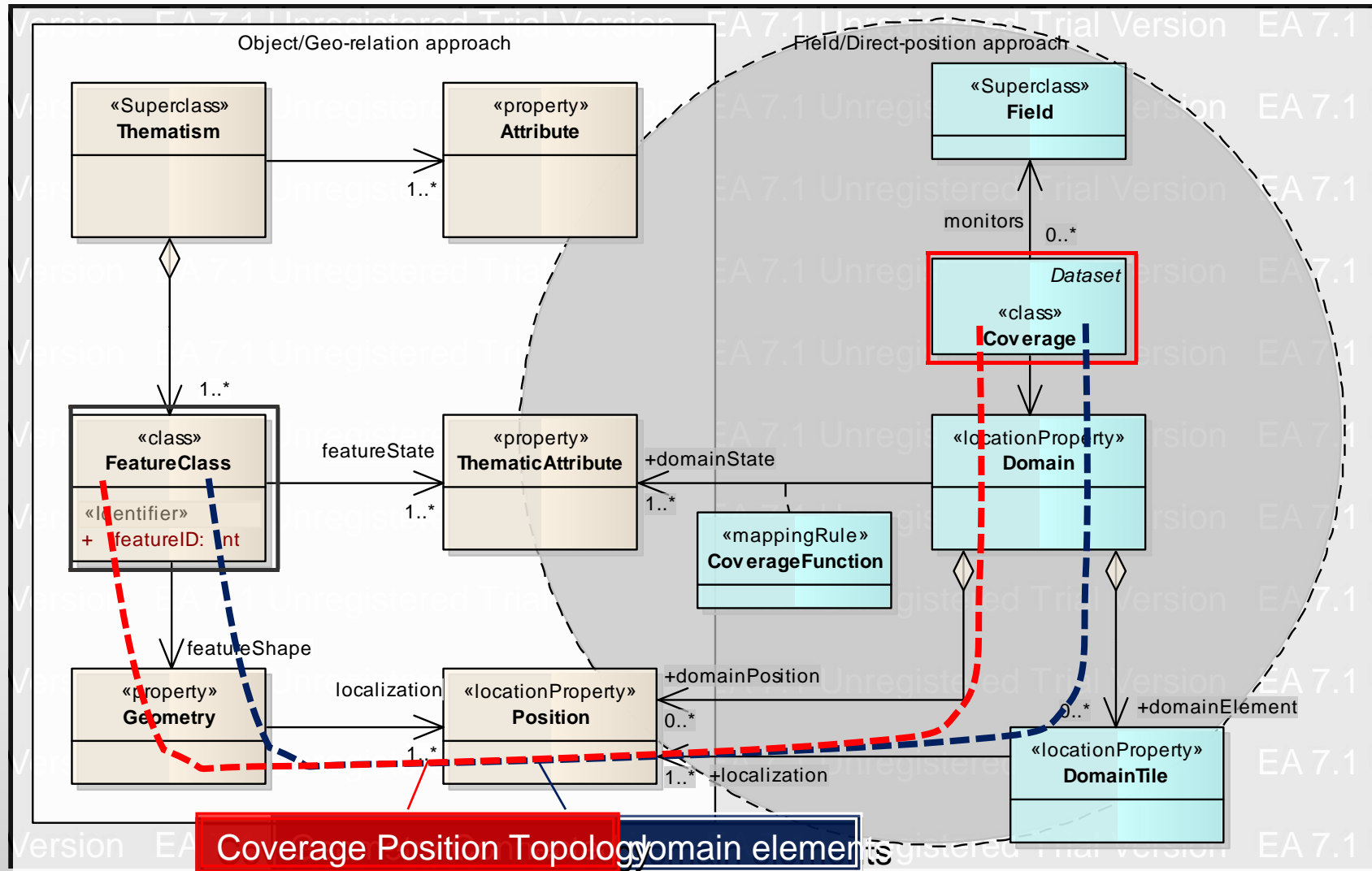


CSML Feature Type	CDM Feature Type
PointFeature	PointFeature
PointSeriesFeature	StationFeature
TrajectoryFeature	TrajectoryFeature
PointCollectionFeature	StationFeature at fixed time
ProfileFeature	ProfileFeature
ProfileSeriesFeature	StationProfileFeature at one location and fixed vertical levels
RaggedProfileSeriesFeature	StationProfileFeature at one location
SectionFeature	SectionFeature with fixed number of vertical levels
RaggedSectionFeature	SectionFeature
ScanningRadarFeature	RadialFeature
GridFeature	GridFeature at a single time
GridSeriesFeature	GridFeature
SwathFeature	SwathFeature

Holistic model for Coverages

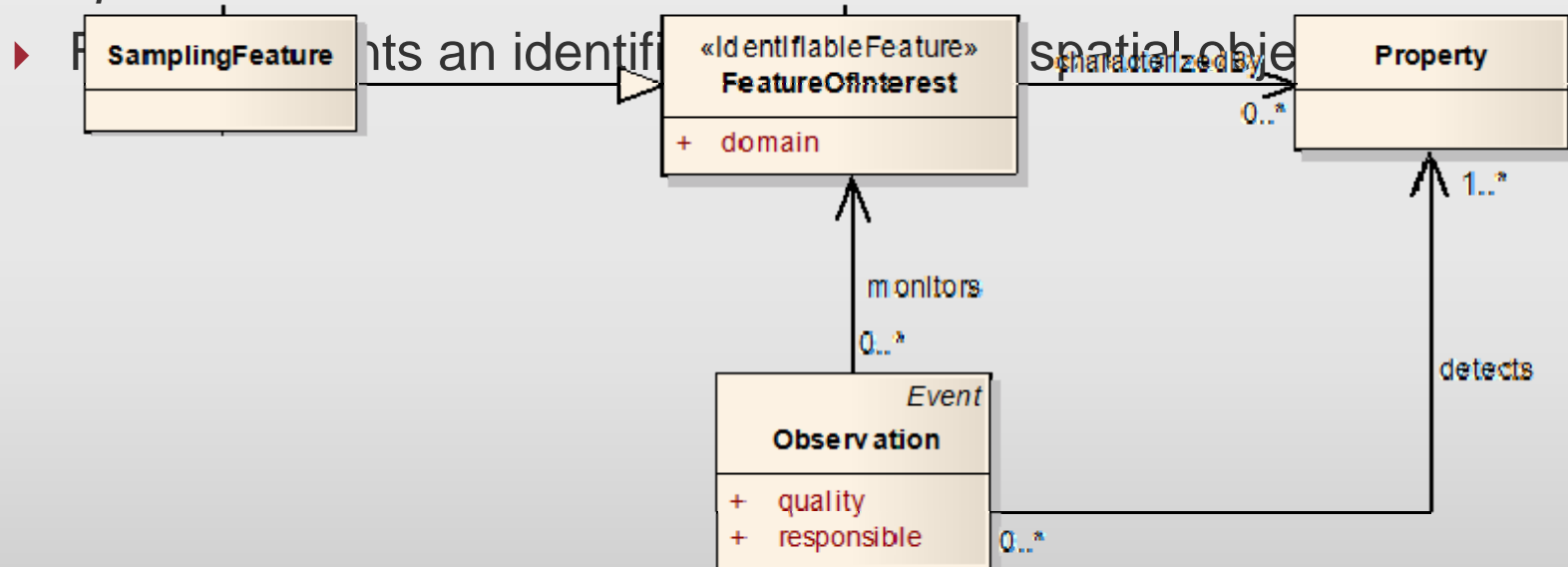
- ▶ For SISE-SEIS, it is particularly important to rely on effective and flexible models and service interfaces for coverage datasets
 - ▶ To develop an holistic approach to model, discover, access and use environmental coverage data types.
 - ▶ Harmonizing it with the General Feature Model (GFM) adopted by the international standardization frameworks for geo-information –e.g. ISO and OGC.

General approaches for Geo-information modeling



Harmonization Model in SISE-SEIS

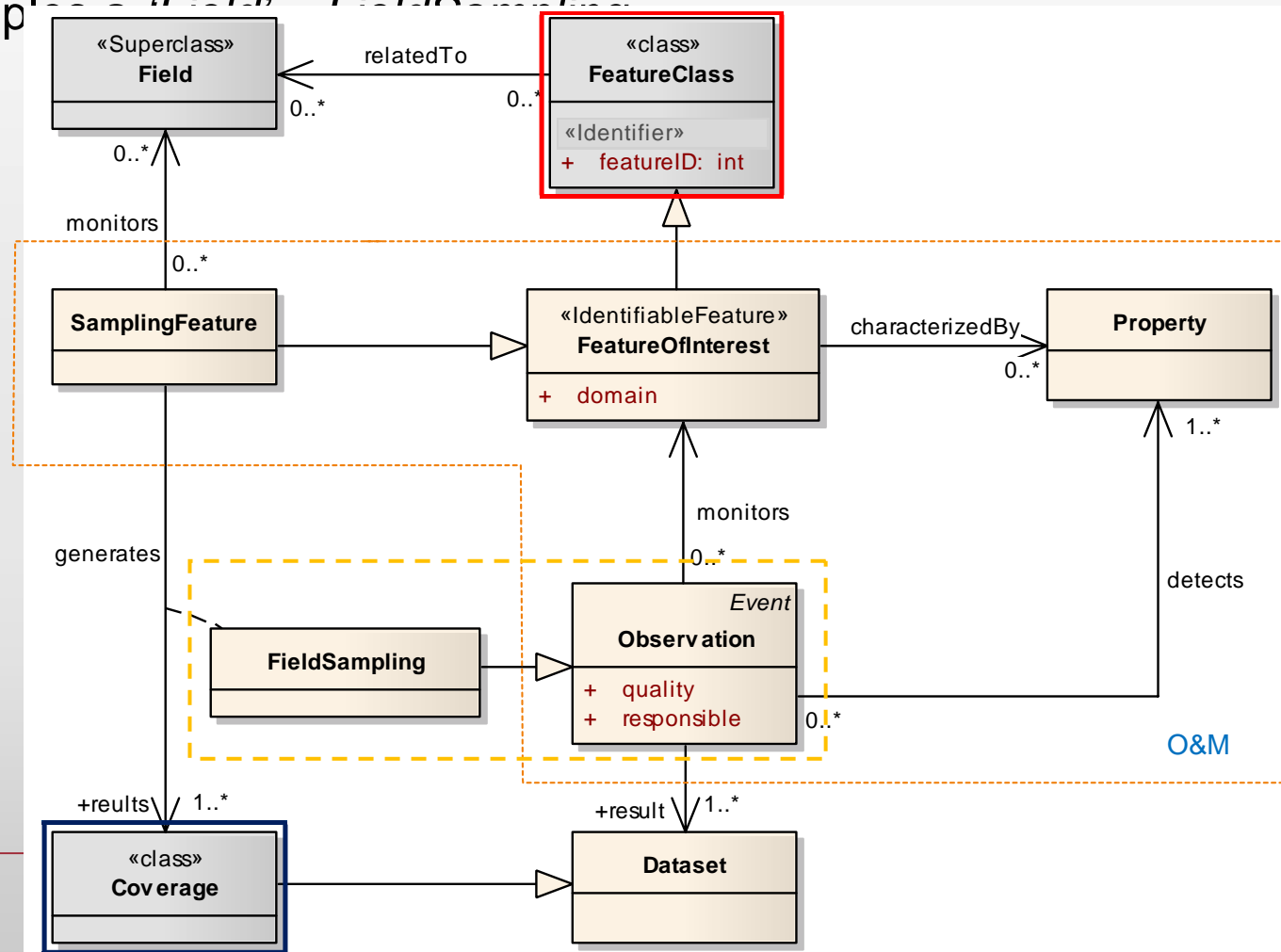
- ▶ Modeling the process of observing or measuring the environment
 - ▶ OGC/ISO Observations and Measurements (O&M) conceptual model
 - ▶ **Observation** is an action whose result is an estimate of the value of some **Property** of a **FeatureOfInterest** (FOI) obtained using a specified **Procedure**.



Harmonization approach: context view

- FOI 'samples' the physical environment = *SamplingFeature* type
 - Examples : weather balloon measuring temperature ; moored tide-gauge measuring sea-level time-series

- Observation sampling
- The observation (field sampling) output is a Coverage

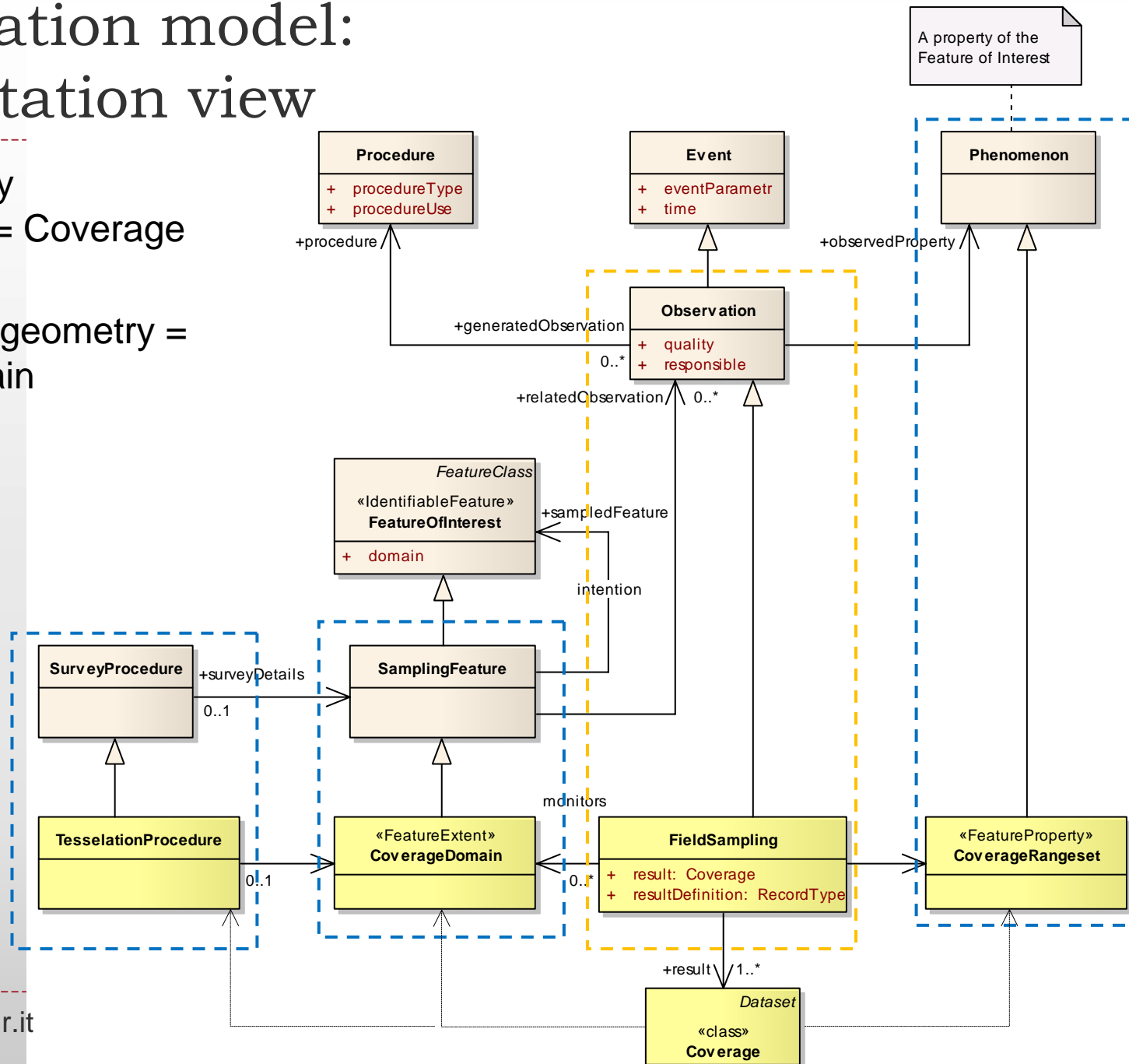


Harmonization model: Implementation view

Observed property
(Phenomenon) = Coverage
Range

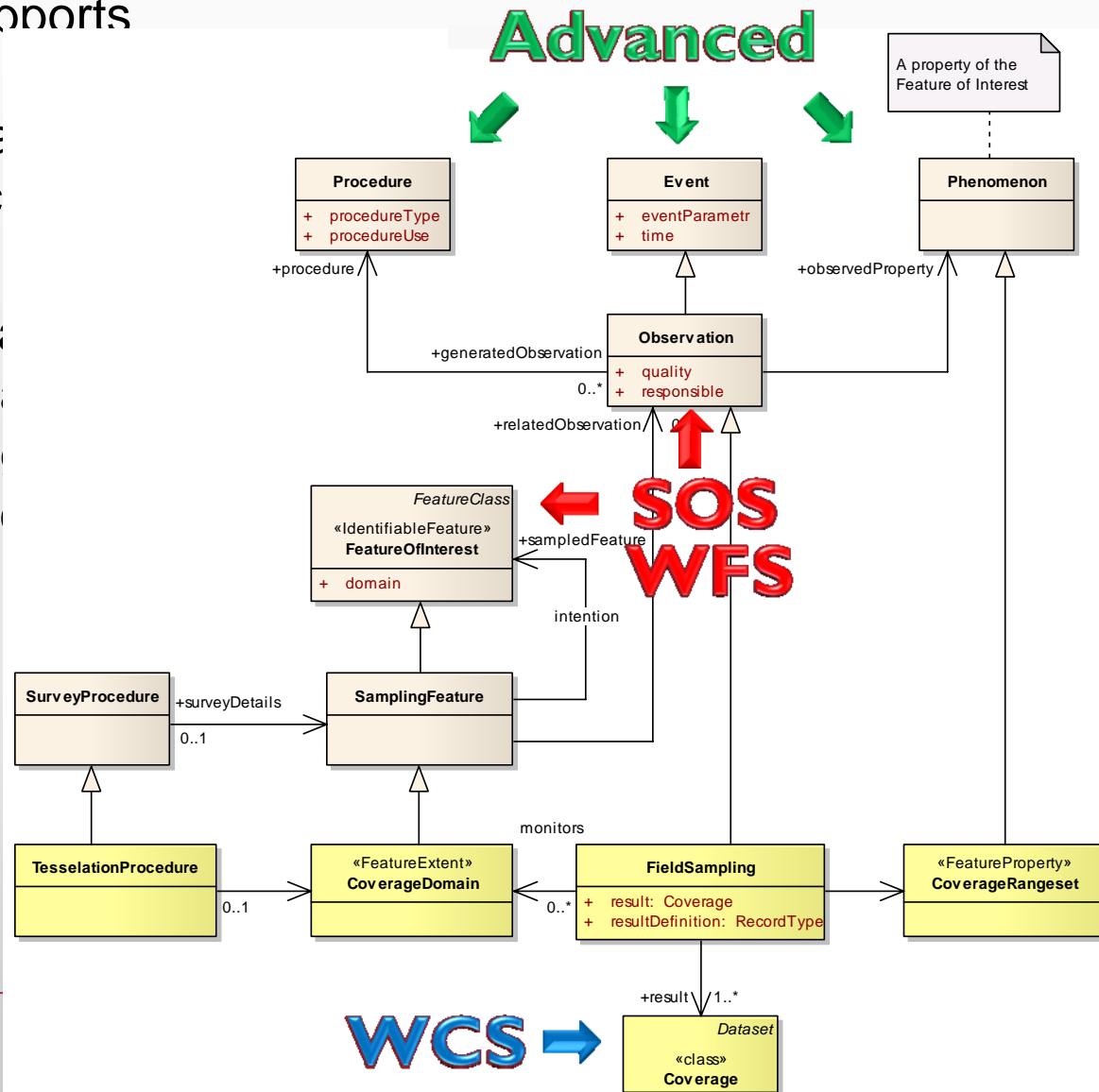
SamplingFeature geometry =
Coverage Domain

Survey procedure
may include
tessellation
information



Access Services

- ▶ The harmonized model supports both the traditional feature (e.g. FOI) and coverage based (e.g. sampled datasets) access services
- ▶ Besides, it enables an advanced type of access services to high level artifacts, avoiding to discriminate about the structure of their instances and their representations.



Conclusions

- ▶ SISE-SEIS important research challenges include
 - ▶ Holistic interdisciplinary approach for coverages
 - ▶ Lack of common data models and semantics –for ‘field’ and ‘object’ information views
- ▶ We proposed an harmonization model to integrate feature and coverage views utilizing the O&M framework
 - ▶ there exists a real-world ‘ultimate’ FOI having properties that may be represented as continuous coverages.
 - ▶ In many O&M environmental applications, the *FeatureOfInterest* is a *SamplingFeature*, and the result of the *Observation* is a *Coverage*
- ▶ For the case of an observation which realizes a ‘Field’ sampling, *we propose that*
 - ▶ *Observation* (i.e. *FieldSampling*) is the *CoverageFunction* of the Coverage result
 - ▶ *Observed Property (Phenomenon)* is the *Range* of the Coverage result
 - ▶ *SamplingFeature* geometry is the *Domain* geometry of the Coverage result
- ▶ This supports both Feature and Coverage based access services as well as a new advanced type of services to access high level entities

**Thank you
for your attention !**



Back-up slides

Environmental Informatics

- ▶ The growing area of environmental informatics is concerned with providing integrated access to a range of advanced information and processing resources for the environment.
 - ▶ AGU-ESSI (Earth and Space Sciences Informatics) focus group
 - ▶ EGU-ESSI division

