European conference of the Czech Presidency of the Council of the EU TOWARDS eENVIRONMENT
Opportunities of SEIS and SISE: Integrating Environmental Knowledge in Europe
(Prague, March 25-27, 2009)

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

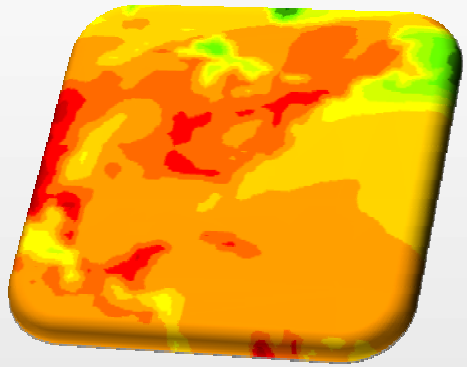
- The information modeling approach is novel to the environmental and earth science communities
- There are significant challenges in bridging the conceptual gap
- Valuable experiences in the geosciences and atmosphere/ocean
  - Example is represented by the OGC GALEON IE
    - To foster interoperability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

SISE (Single Information Space for the Environment) in Europe

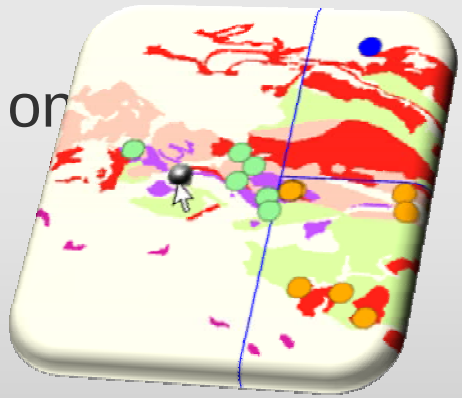
- Important research challenges include
  - Holistic interdisciplinary approaches
  - Lack of common data models and semantics
- Geospatial information (ISO, OGC) modeling introduced two fundamental concepts to map discrete and continuous real world phenomena
  - Feature
  - Coverage
    - Feature subtype 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

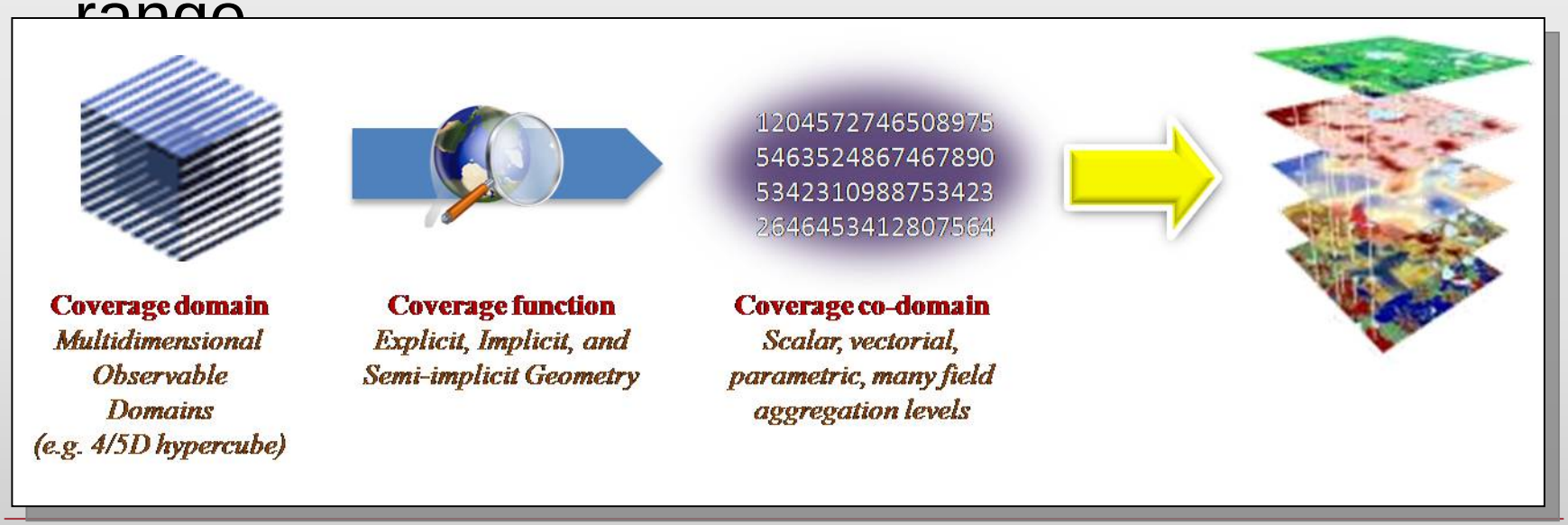


- A ‘feature’ or geo-relational or object view of information
  - “Land managers” and Geologists focus more on entities, objects, features (discrete entities)



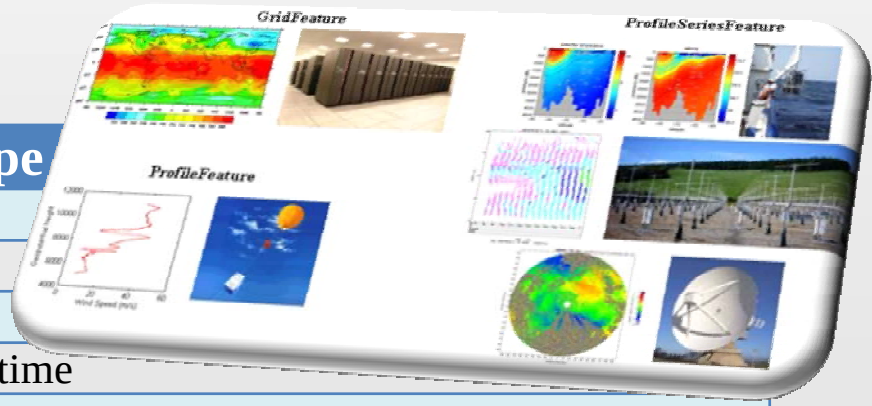
Coverage concept

- 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

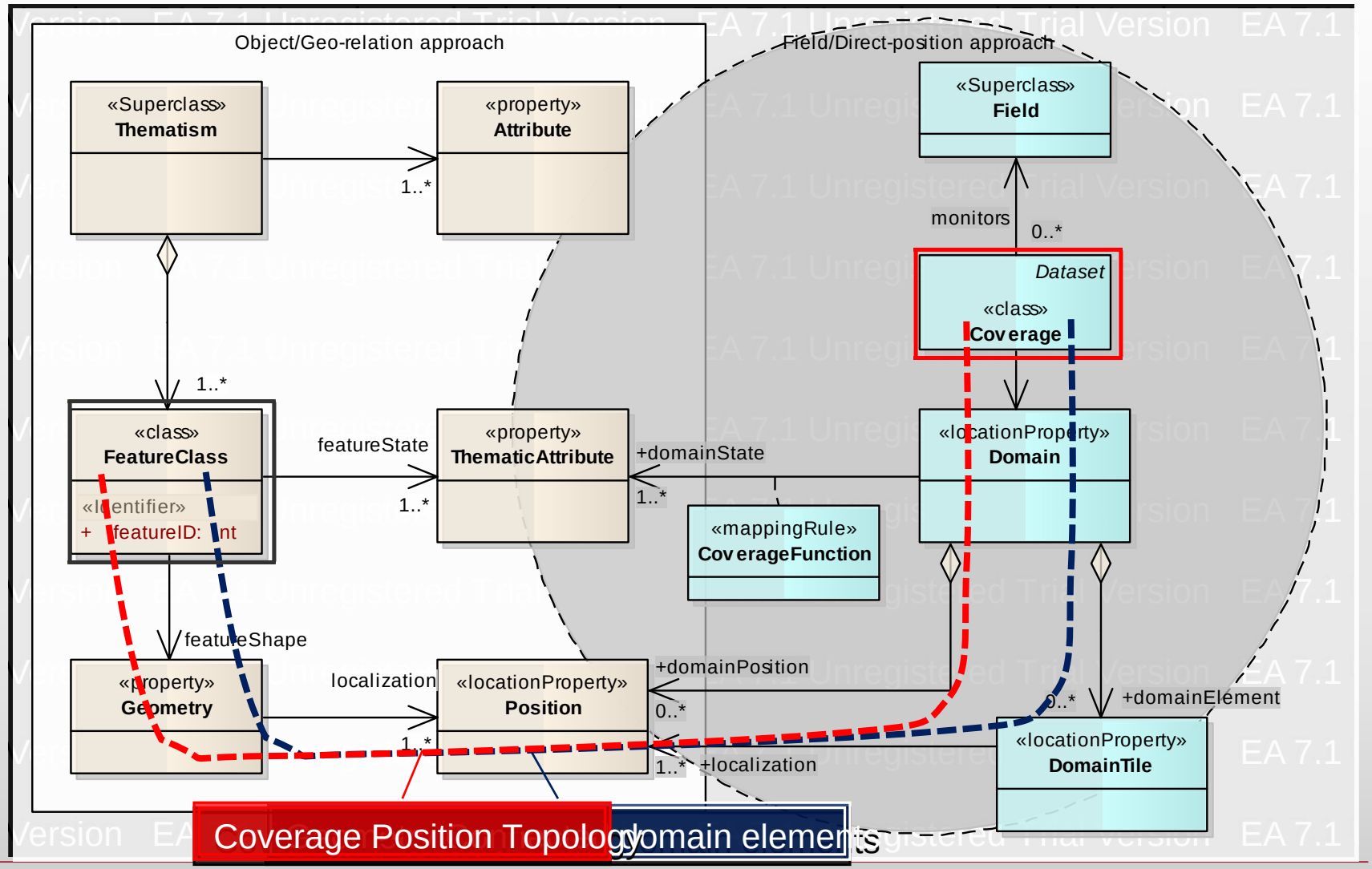


CSML Feature Type	CDM Feature Type
PointFeature	PointFeature
PointSeriesFeature	StationFeature
TrajectoryFeature	TrajectoryFeature
PointCollectionFeature	StationFeature at fixed time
ProfileFeature	ProfileFeature
ProfileSeriesFeature	StationProfileFeature at one location and fixed vertical levels
RaggedProfileSeriesFeature	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



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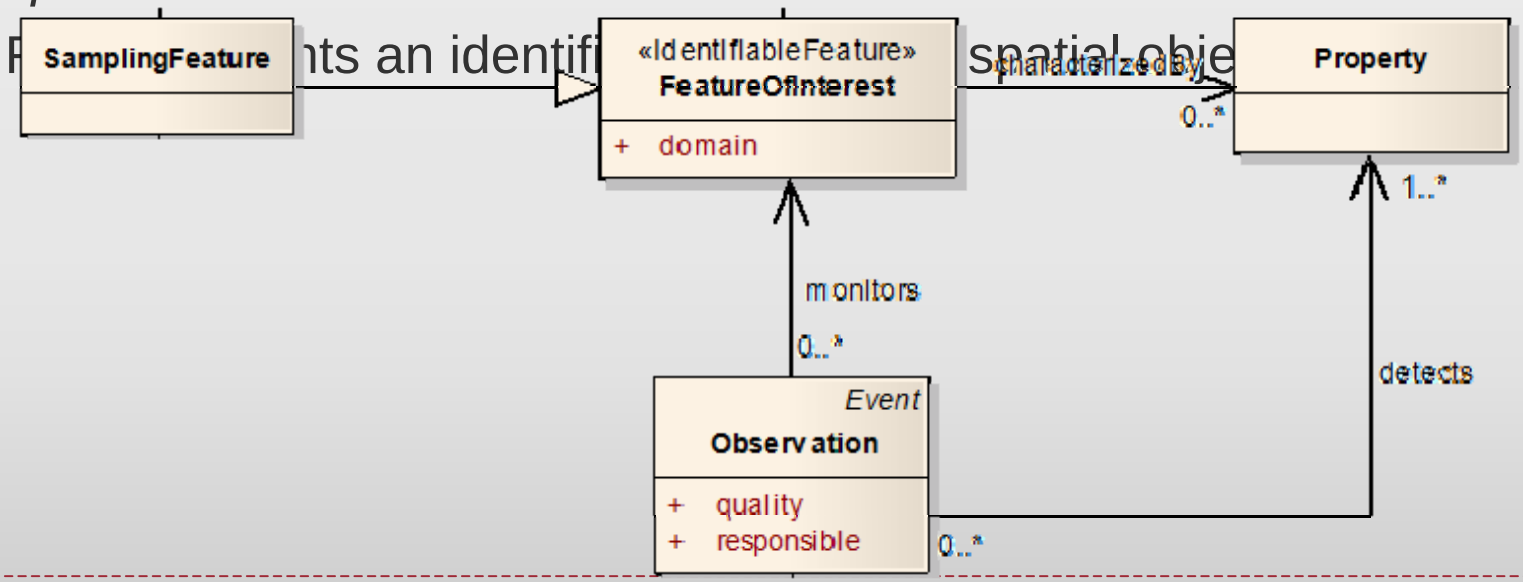
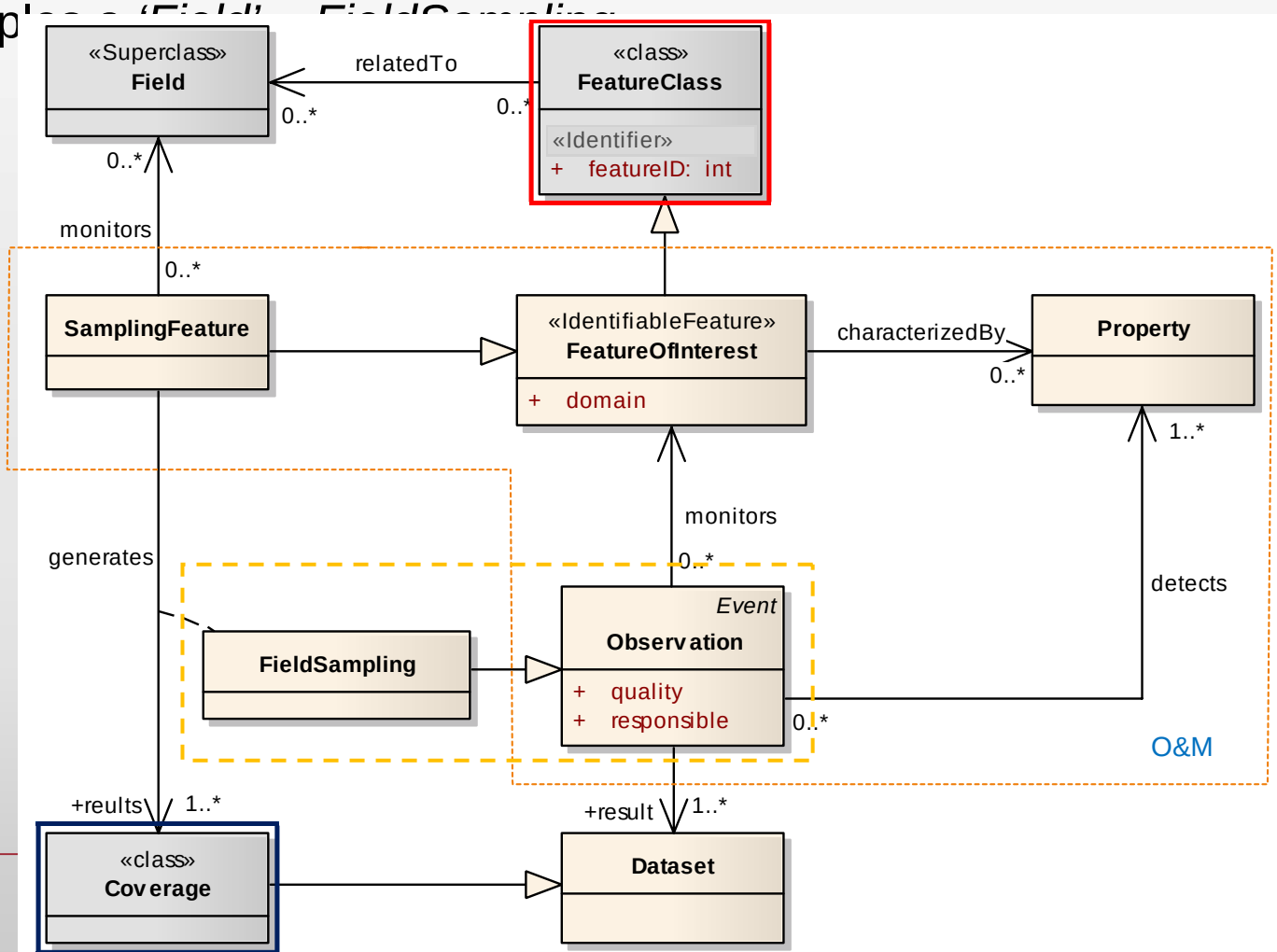
Harmonization Model in SISE-SEIS

- 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****.*
  - F… …nts an identifi… …spatial obje…



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* samples a *‘Field’ – FieldSampling*
- The observation (field sampling) output is a Coverage



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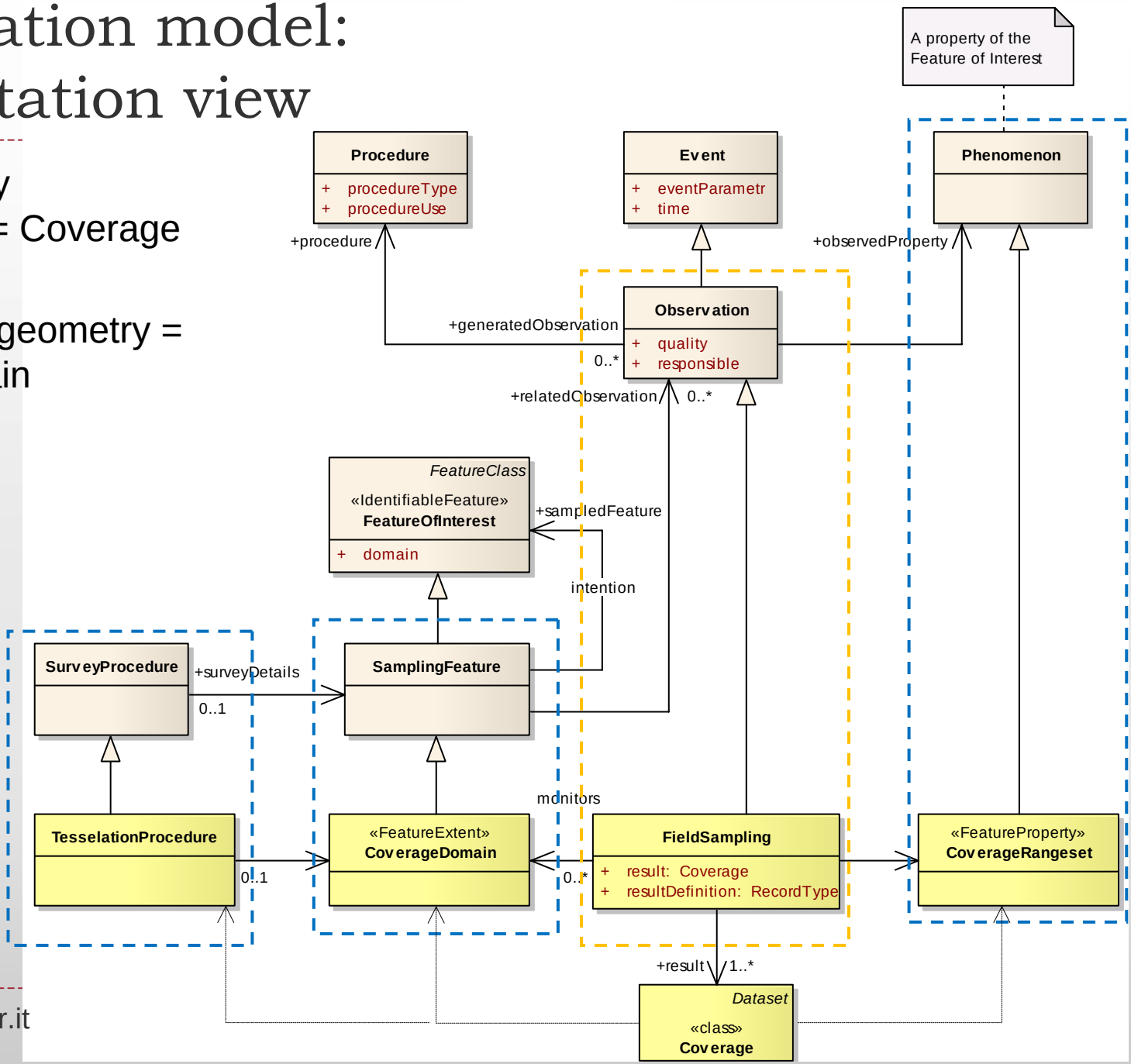
Harmonization model: Implementation view

- Observed property (Phenomenon) = Coverage Range
- SamplingFeature geometry = Coverage Domain
- Survey procedure may include tesselation information



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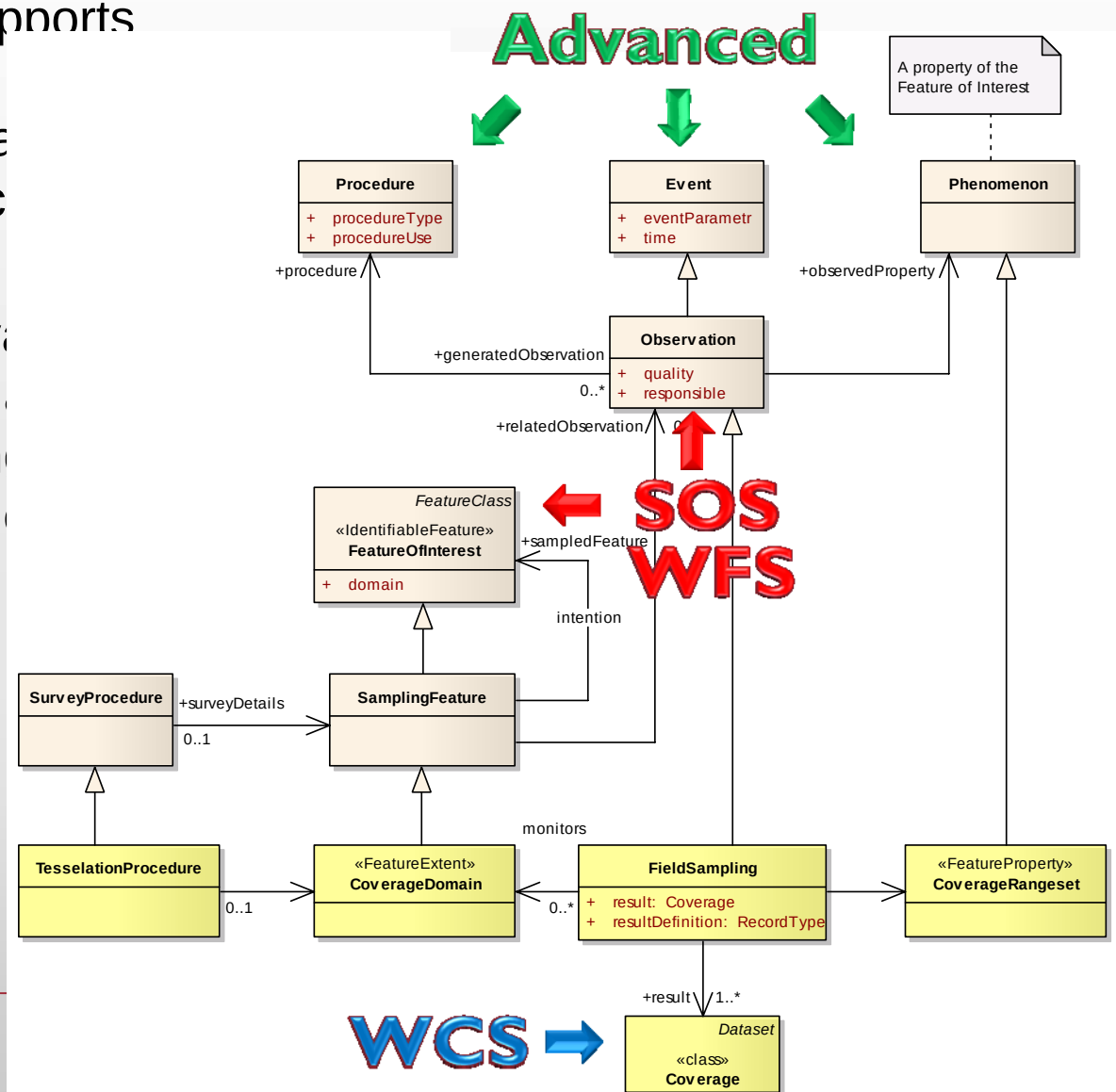
Access Services

- The harmonized model supports both the traditional feature (e.g. FOI) and coverage ba (e.g. sampled datasets) ac services
- Besides, it enables an adva type of access services to high level artifacts, avoidin discriminate about the stru their instances and representations.



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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

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Thank you

for your attention !

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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