Feel the power of INSPIRE WCS / WCPS in your hands!

INSPIRE Thematic Clusters #3 & #4

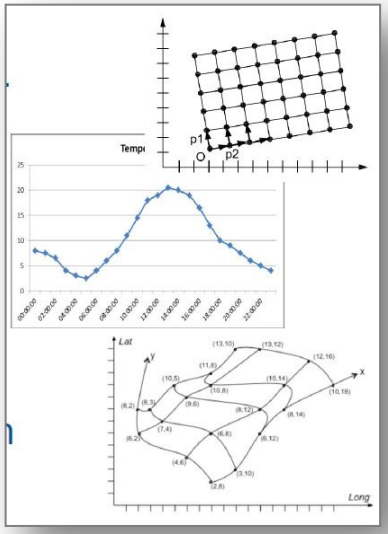
Elevation, Orthoimagery, Reference systems and Geographical grids

Observations & Measurements

Peter Baumann & Kathi Schleidt & Jordi Escriu

European Commission

Joint Research Centre



DATA COVE

rasdaman
raster data management

JACOBS UNIVERSITY

INSPIRE - Infrastructure for Spatial Information in Europe

IDEC
Infraestructura de Dades Espacials de Catalunya

ICGC
Institut Cartogràfic i Geològic de Catalunya

INSPIRE WCS / WCPS in your hands
Workshop agenda

- Introduction & Survey
- State of play of Coverage data and WCS/WCPS standardization in OGC/ISO
- State of play of coverage data in INSPIRE
- Practical WCS / WCPS exercise
- Conclusions for the future evolution of INSPIRE Coverages

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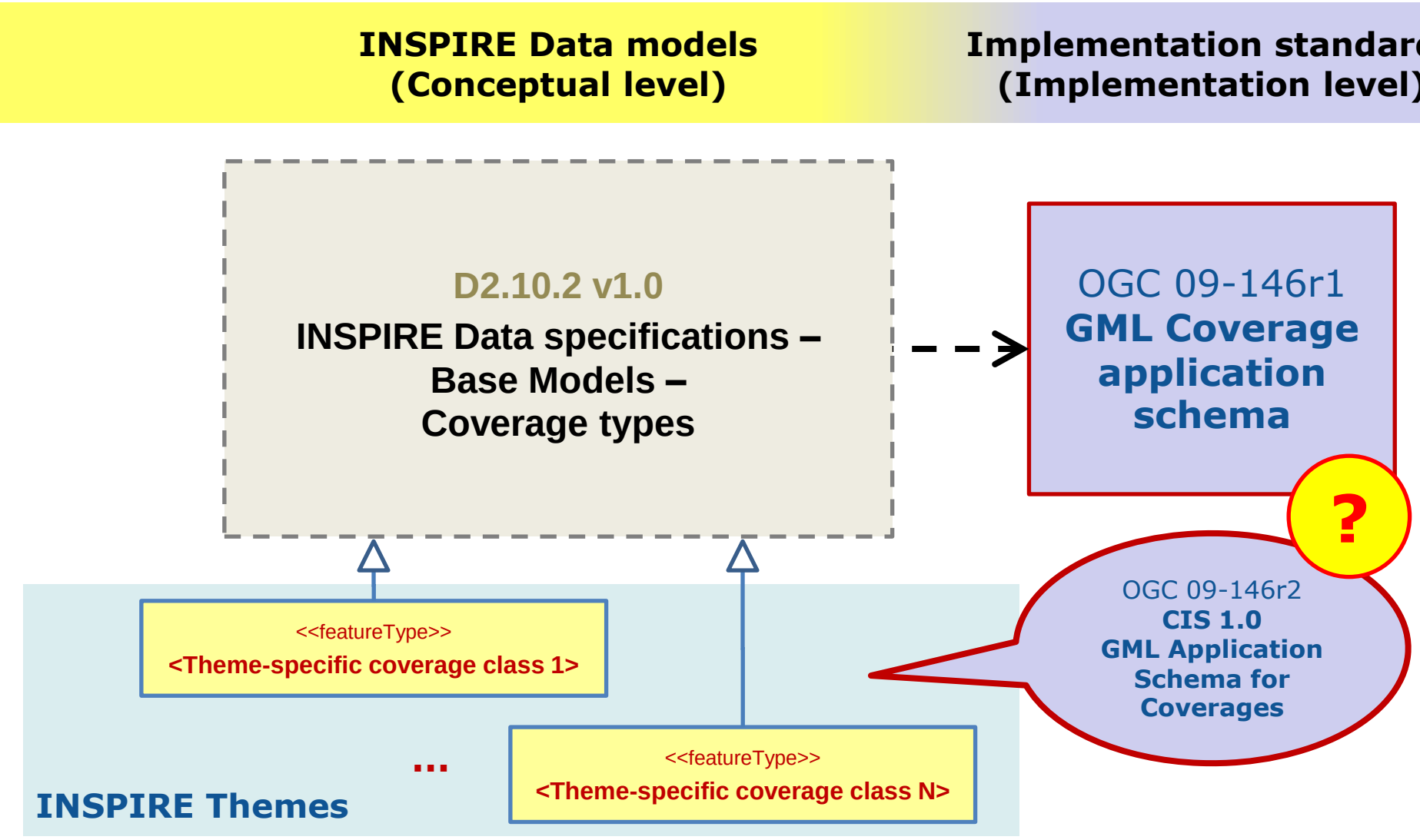
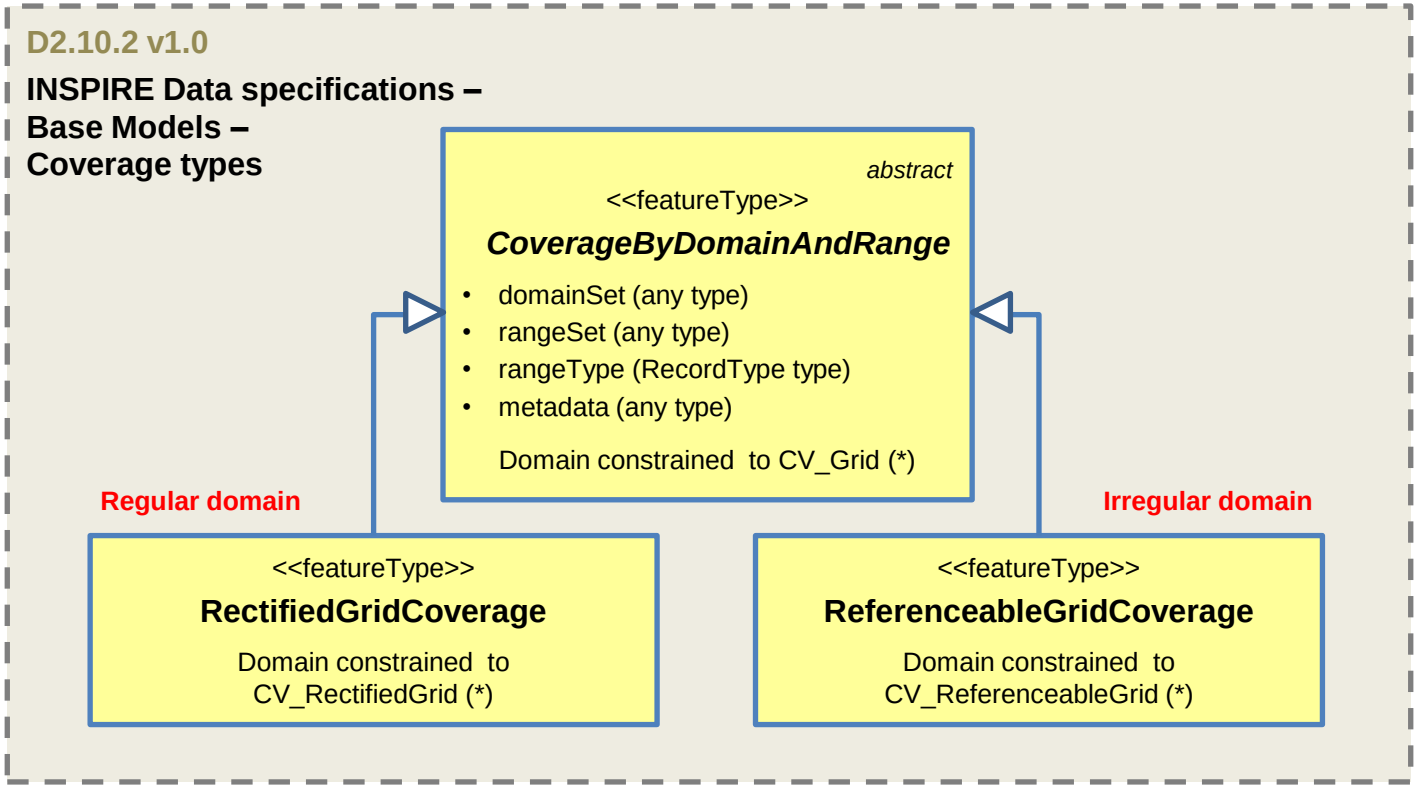
INSPIRE Coverages
Modelled at conceptual level



INSPIRE Coverages

Common seed model for all INSPIRE themes



Regular grids **Irregular grids**

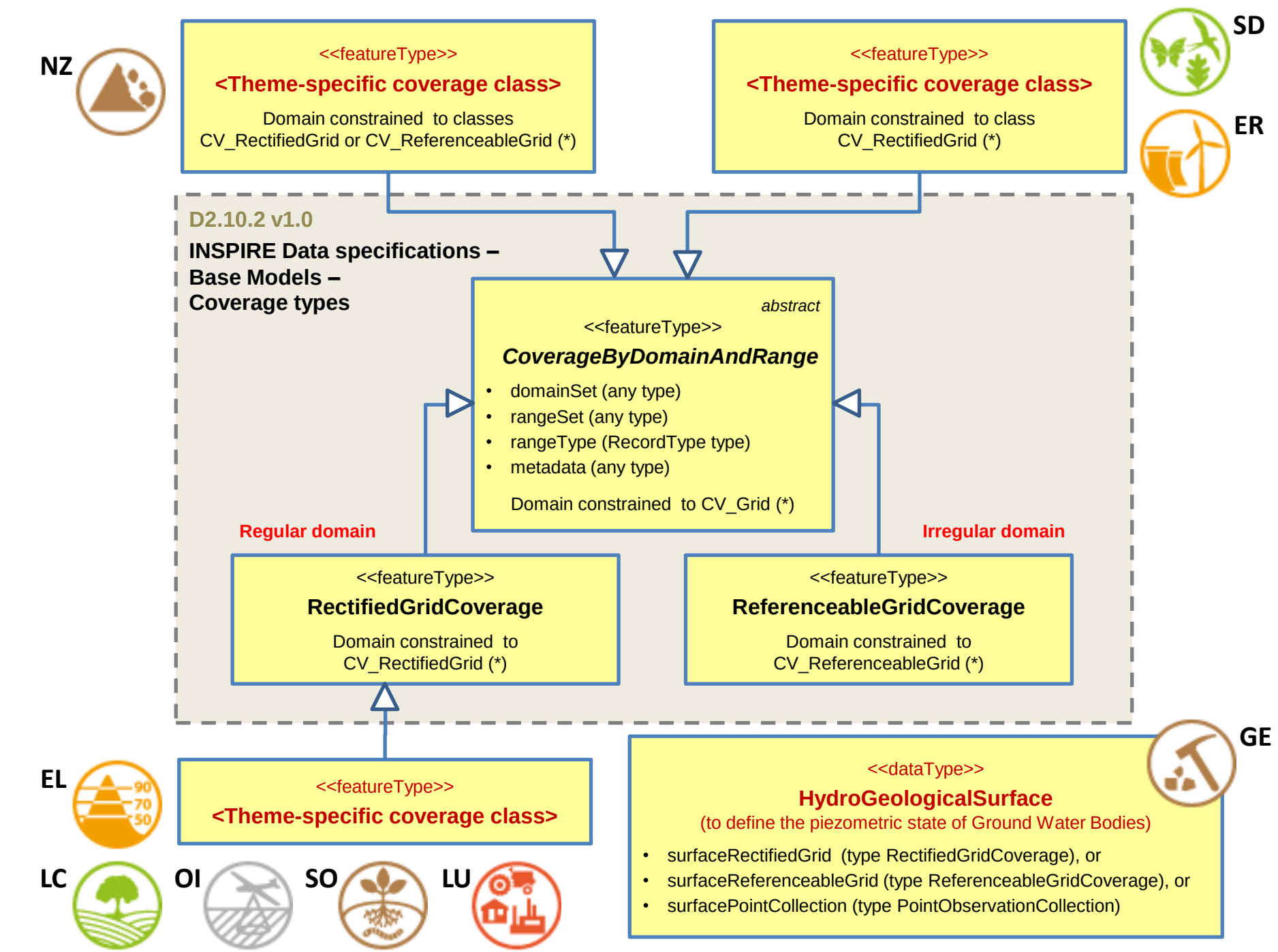
Use of coverages in INSPIRE

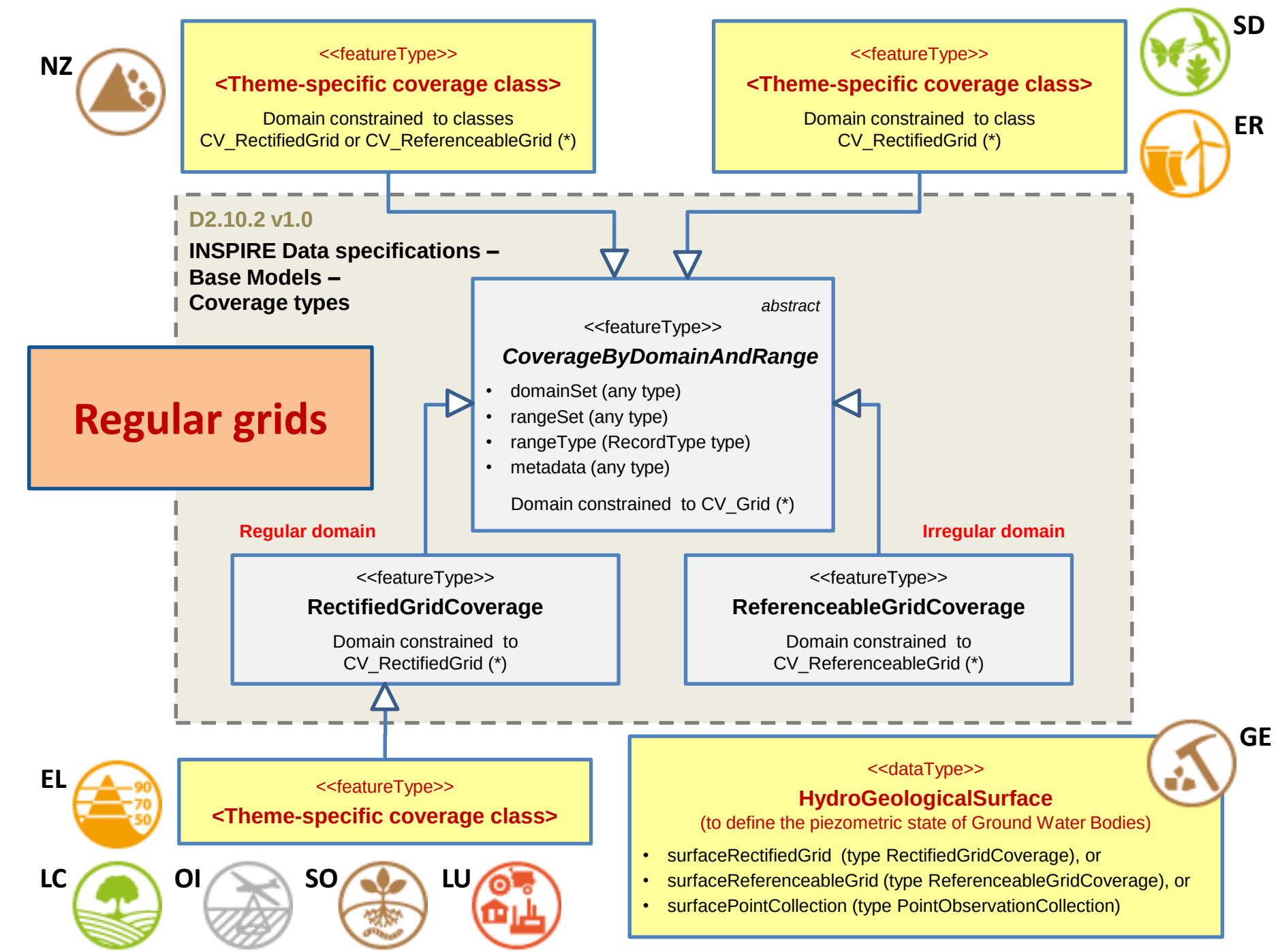
- **WCS view: Coverages as Features**
- **SOS view: Coverages as Observation Results**

WCS view: Coverages as Features

INSPIRE FeatureTypes based on Coverage Classes

- **Regular grids**:
  - Elevation (EL)
  - Land cover (LC)
  - Orthoimagery (OI)
  - Soil (SO)
  - Energy resources (ER).
  - Species distribution (SD) - Application schema deprecated.
- **Regular or Irregular grids:**
  - Natural risk zones (NZ)
  - Geology (GE).


NZ
<<featureType>>
<Theme-specific coverage class>
Domain constrained to classes
CV_RectifiedGrid or CV_ReferenceableGrid (*)
<<featureType>>
<Theme-specific coverage class>
Domain constrained to class
CV_RectifiedGrid (*)
SD
ER
D2.10.2 v1.0
INSPIRE Data specifications –
Base Models –
Coverage types
abstract
<<featureType>>
CoverageByDomainAndRange
domainSet (any type)
rangeSet (any type)
rangeType (RecordType type)
metadata (any type)
Domain constrained to CV_Grid (*)
Regular domain
Irregular domain
<<featureType>>
RectifiedGridCoverage
Domain constrained to
CV_RectifiedGrid (*)
<<featureType>>
ReferenceableGridCoverage
Domain constrained to
CV_ReferenceableGrid (*)
EL
<<featureType>>
<Theme-specific coverage class>
GE
<<dataType>>
HydroGeologicalSurface
(to define the piezometric state of Ground Water Bodies)
surfaceRectifiedGrid (type RectifiedGridCoverage), or
surfaceReferenceableGrid (type ReferenceableGridCoverage), or
surfacePointCollection (type PointObservationCollection)
LC
OI
SO
LU
(*) From ISO 19123:2007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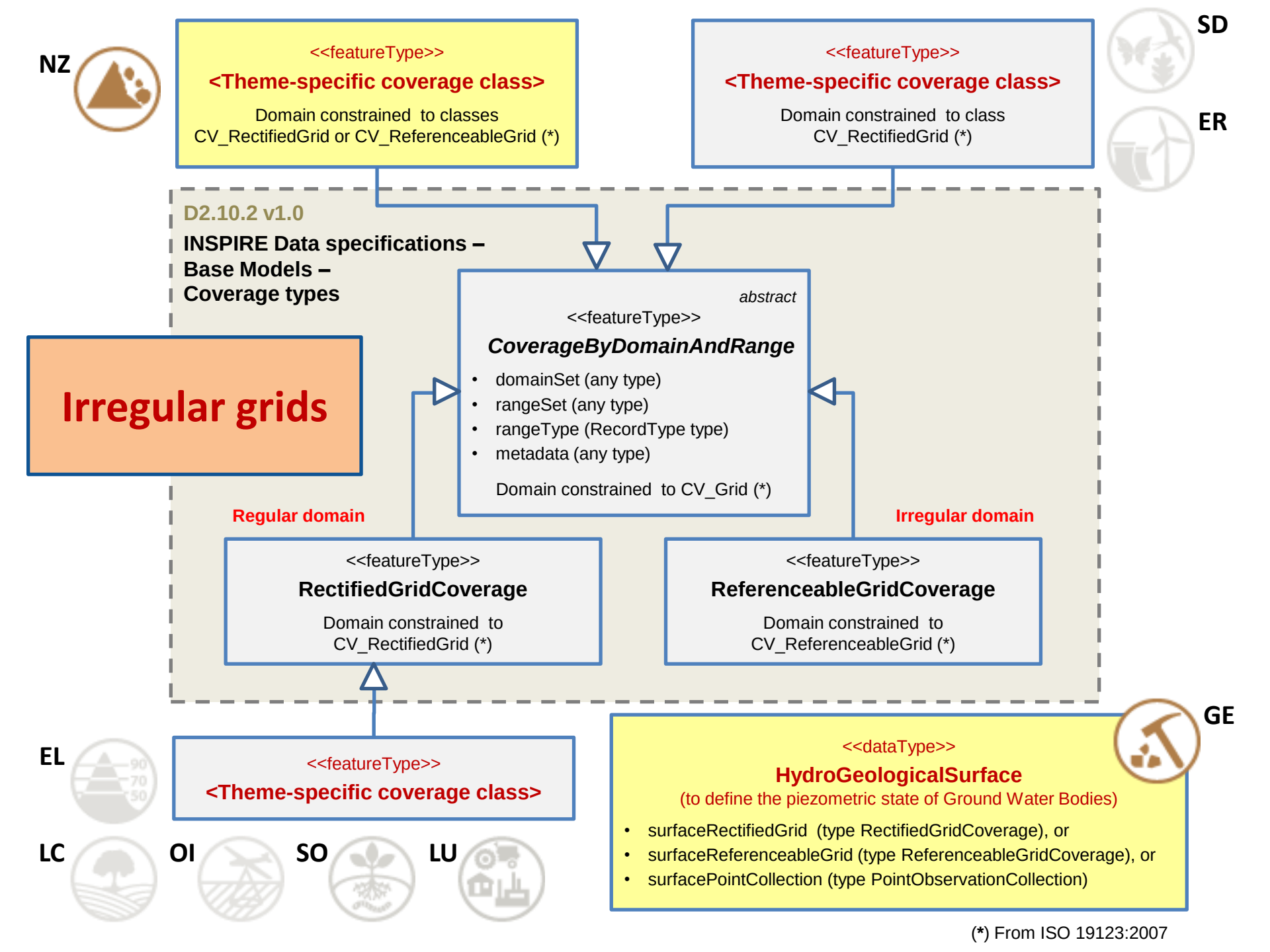
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SOS view: Coverages as Observation Results

- **Regular or irregular grids**
  - Environmental monitoring facilities (EF)
  - Atmospheric conditions (AC)
  - Meteorological geographic features (MF)
  - Oceanographic geographic features (OF)
  - Geology (GE)
- Provided as discrete observation coverages, i.e. gridded data specialized observation types applying the ISO 19156:2011 (O&M), following *INSPIRE D2.9 v3.0*

SOS view: Coverages as Observation Results

Coverage based models in the observational context

D2.9 v3.0

INSPIRE Guidelines for the use of
Observations & Measurements and Sensor Web Enablement-related standards
in INSPIRE Annex II and III data specification development

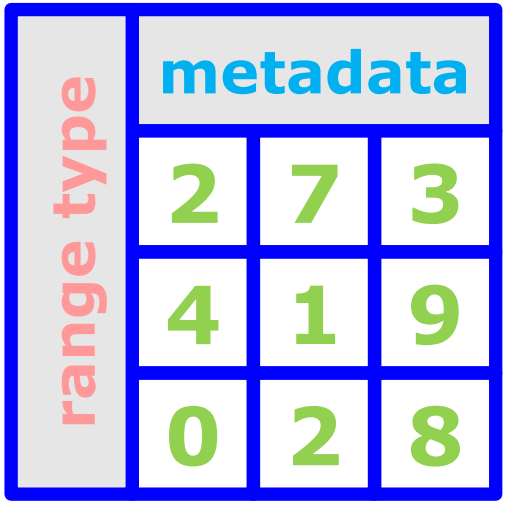
Based on ISO 19156:2011 Observations and Measurements standard (O&M in OGC)

Use of Gridded Data specialized observation types.

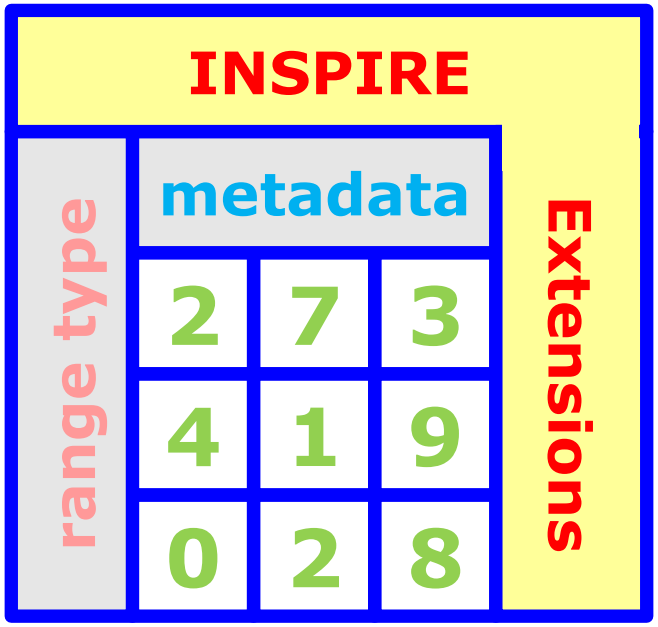
Implementation of INSPIRE Coverage

What is exactly the issue? INSPIRE Extensions

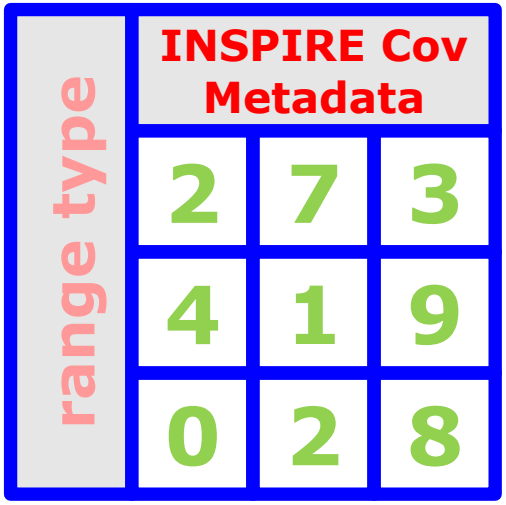
OGC CIS1.0
Implementation model



INSPIRE
Conceptual model



INSPIRE
Implementation model
(PROPOSAL)



Implementation of INSPIRE Coverages

What we have done till today

- **"Implementation of INSPIRE Coverages" – Webinar**:

  https://inspire.ec.europa.eu/forum/pages/view/159283/webinar-implementation-of-inspire-coverages

- **"Practicing INSPIRE coverages - Enhancing your data cube implementation assets!" – Workshop**, INSPIRE Conference 2008 Antwerp:

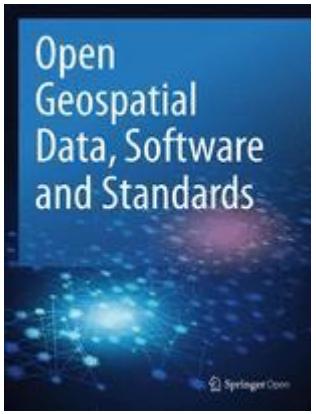
  https://inspire.ec.europa.eu/events/conferences/inspire_2018/submissions/248.doc

Implementation of INSPIRE Coverages

What we have done till today

- **"INSPIRE coverages: an analysis and some suggestions" - Article** with first suggestions:

  https://link.springer.com/article/10.1186%2Fs40965-019-0059-x



- **Results presented in this workshop, applied to OI, EL, LC**:
  - Proposal of INSPIRE coverage (metadata) schemas – To be refined.
  - Examples of WCS services.
  - Examples of INSPIRE coverage metadata.

Implementation of INSPIRE Coverages

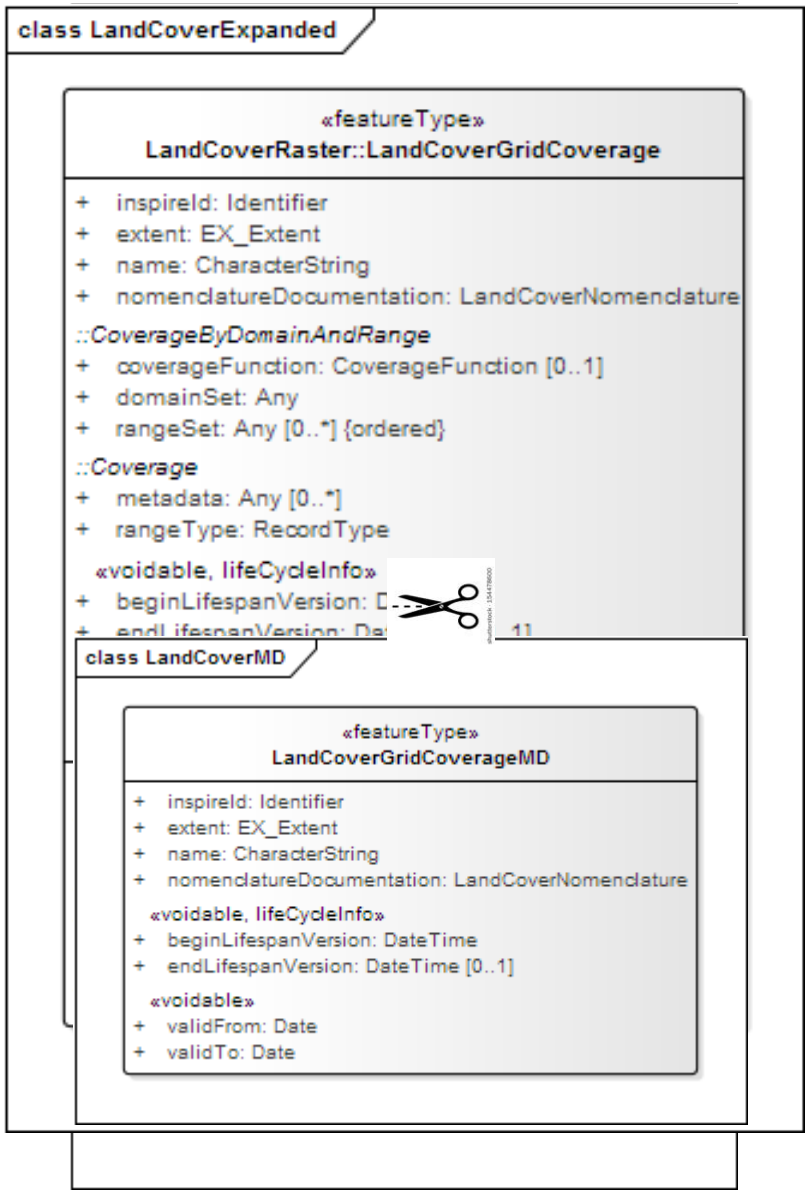
What we want to do after this workshop

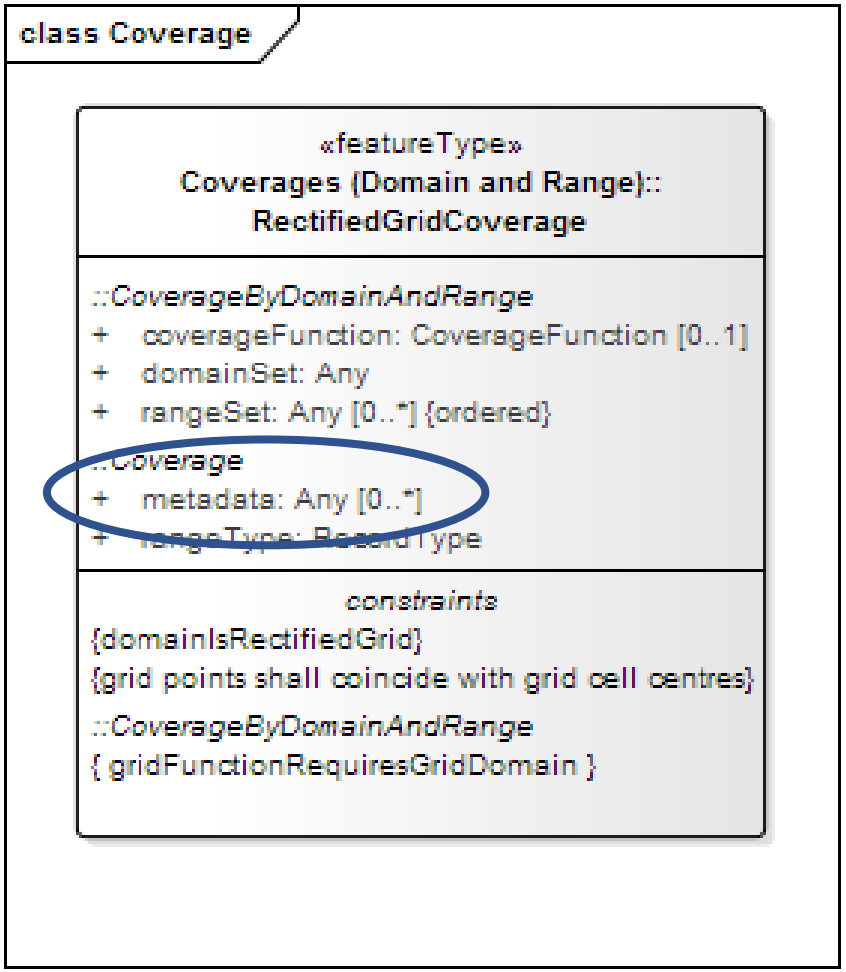
- **Enumerate a list of changes to INSPIRE framework.**
  - Adopt OGC CIS1.0 schema as interoperable implementation model for INSPIRE coverages.
  - Update the existing INSPIRE coverage schemas to become INSPIRE coverage metadata schemas (i.e. consider INSPIRE extensions as coverage metadata elements).
  - Revise consistency of INSPIRE TGs to CIS1.0, including UML conceptual models.
  - Possibly, draft a proposal to update the seed model for INSPIRE Coverages (D1.10.2) to align it OGC CIS.

(Scoped to OI & EL initially)

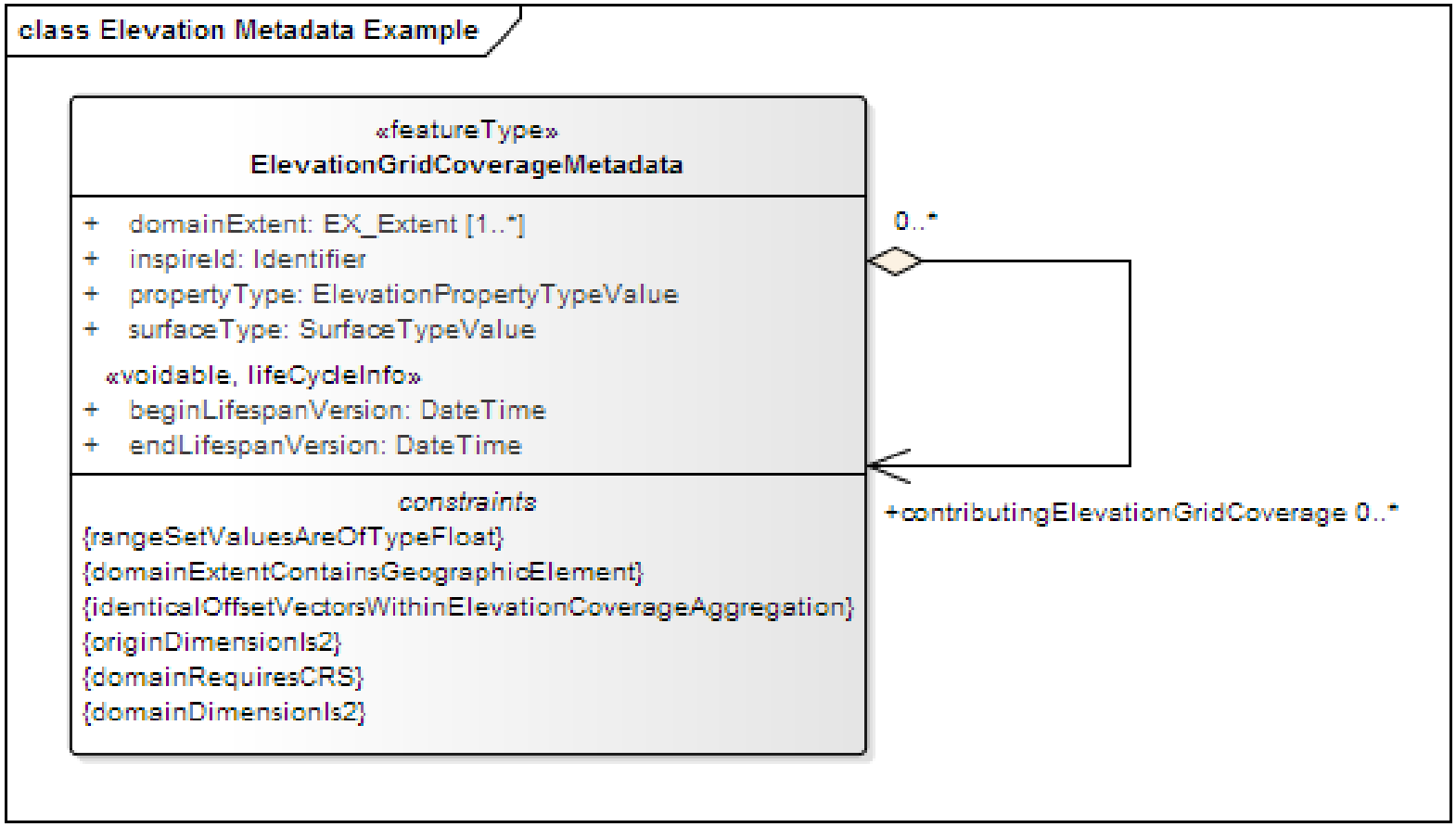
- **Document all this changes.**
- **Present the proposals for change to INSPIRE MIG.**
- **Look forward to INSPIRE MIG endorsement.**

Coverage Metadata Model

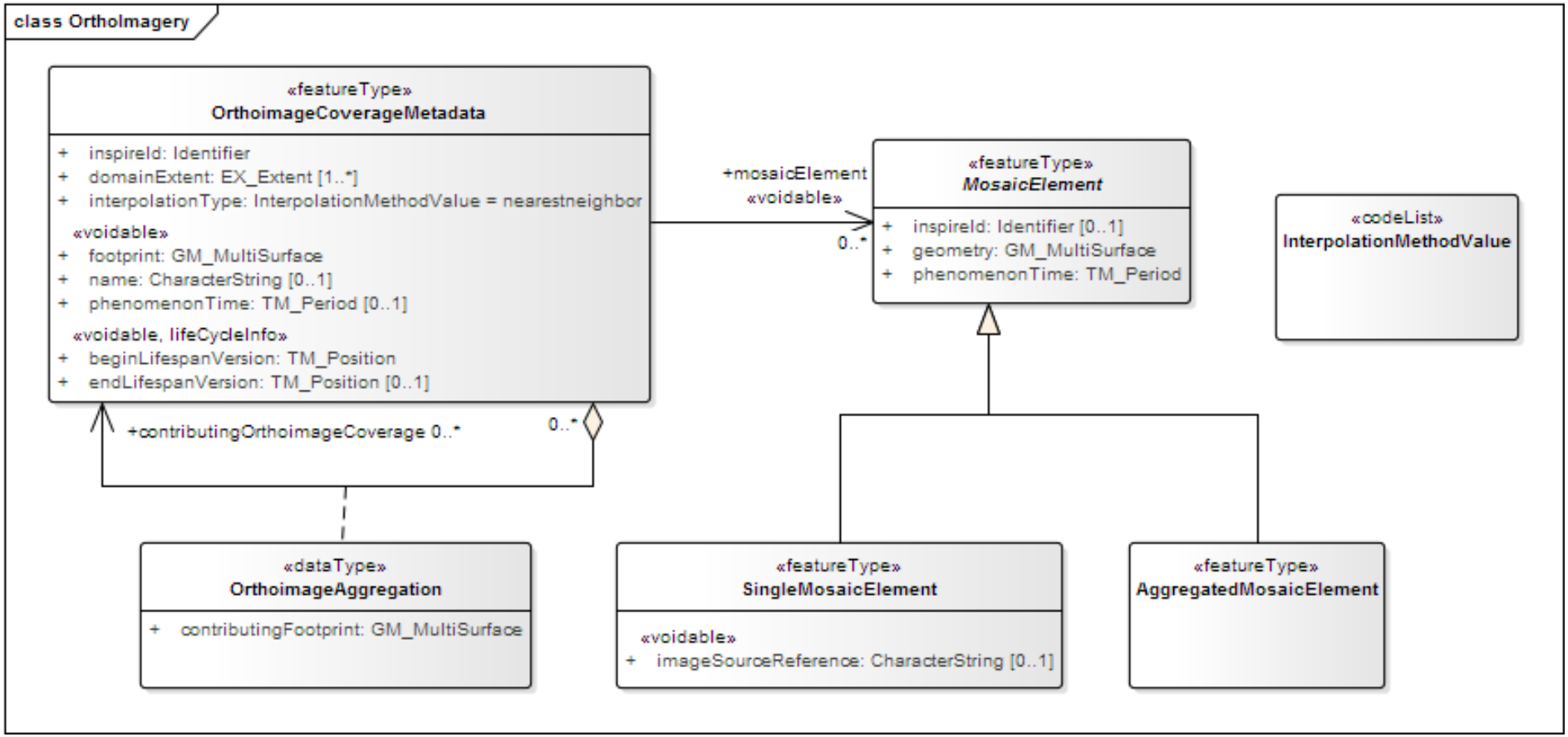




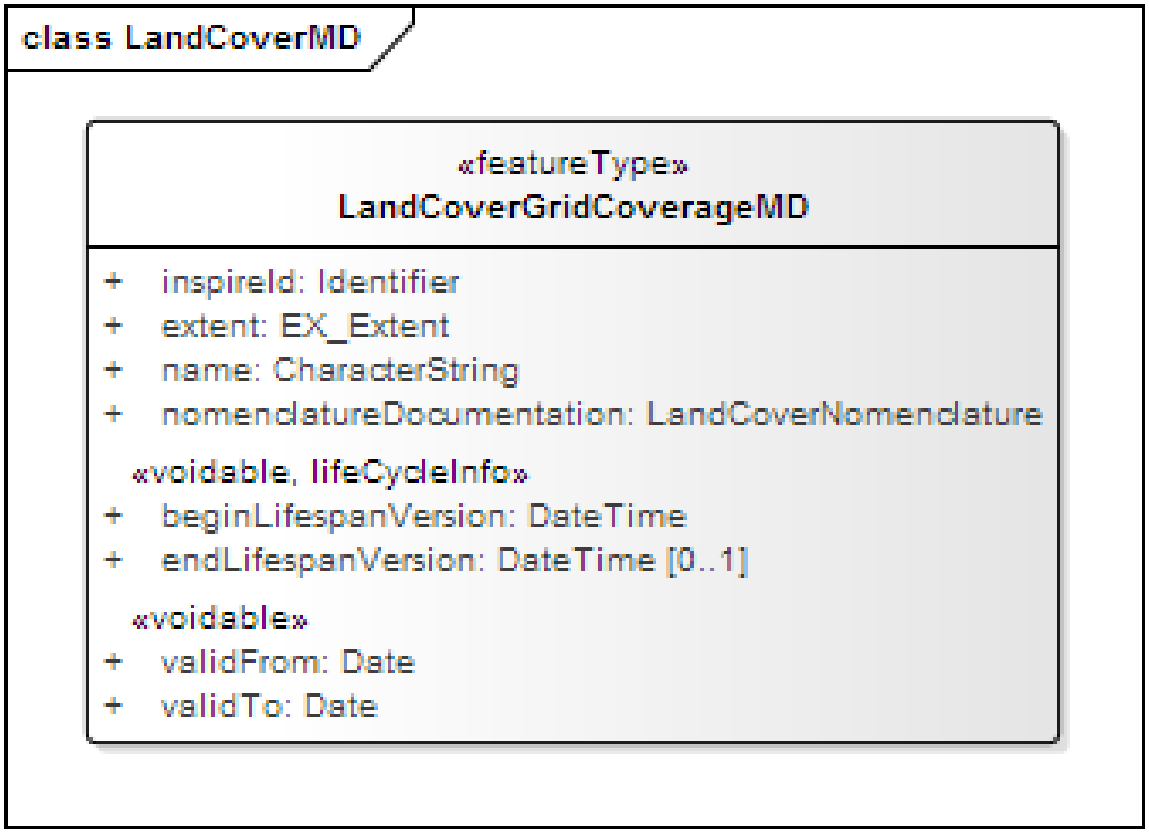
Elevation Coverage Metadata



OrthoImagery Coverage Metadata



Land Cover Coverage Metadata



Schema files

- https://schema.datacove.eu/OrthoimageryMetadata.xsd
- https://schema.datacove.eu/ElevationGridCoverageMetadata.xsd
- http://test.datacove.eu/LandCoverRasterMDExt.xsd

Coverages Online!

http://ows.rasdaman.org/rasdaman/ows

- OI: INSPIRE_OI_RGB
- OI: INSPIRE_OI_IR
- EL: INSPIRE_EL
- LC: INSPIRE_WS_LC

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INSPIRE WCS / WCPS in your hands
Practical WCS / WCPS exercise

- **Data used in the exercise**

  Provided by Institut Cartogràfic i Geològic de Catalunya (ICGC)

  - **Orthoimagery (OI)** – 2.5 m resolution
    - OI RGB: **INSPIRE_OI_RGB**
    - OI IR: **INSPIRE_OI_IR**
  - **Elevation (EL)** – 2 m resolution
    - EL: **INSPIRE_EL**
  - **Land cover (LC)** – 1 m resolution
    - LC: **INSPIRE_WS_LC**

ICGC
Institut
Cartogràfic i Geològic
de Catalunya

- **Geographical Scope**: [E(492000:496000), N(4654000:4656000)]
- **Available and ingested at**:

  http://ows.rasdaman.org/rasdaman/ows

rasdaman
raster data management

INSPIRE WCS / WCPS in your hands
Practical WCS / WCPS exercise

- Introduction to the working environment
  - rasdaman server & clients
  - http://ows.rasdaman.org/rasdaman/ows
- Code snippets:
  - https://github.com/DataCoveEU/INSPIRE_Coverage
- WCS
  - Navigating rasdaman and WCS
  - Footprints
  - DescribeCoverage request (coverage metadata)
  - GetCoverage request

INSPIRE WCS / WCPS in your hands
Practical WCS / WCPS exercise

- **WCPS**
  - **Orthoimagery (OI)**
    - OI RGB band extraction
    - OI IR band extraction
    - NDVI (Normalized difference vegetation index) calculation:

$$\mathrm{NDVI} = \frac{(\mathrm{NIR} - \mathrm{Red})}{(\mathrm{NIR} + \mathrm{Red})}$$

  - **Elevation (EL)**
    - EL height classification using specific range

INSPIRE WCS / WCPS in your hands
Practical WCS / WCPS exercise

- **WCPS**
  - **Land cover (LC)**
    - LC extraction of specific classes, as masks.
    - LC coloring of specific LC classes.
    - LC coloring of all classes.
  - **Data fusion (OI RGB, OI IR, EL, LC)**
    - NDVI in locations with specific LC classes at a concrete EL range, overlaid on OI RGB layer.
- **WMS**
  - **Presentation of results**
    - Show OI RGB or OI IR as a layer in a web viewer.
    - Show style definition for a layer derived dynamically, e.g. band selection or NDVI.

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Thanks for your attention!

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