GIS Data Models for INSPIRE and ELF

Roberto Lucchi, Paul Hardy

{rlucchi | phardy}@esri.com

Geospatial World Forum
Lisbon, Portugal
May 28th, 2015

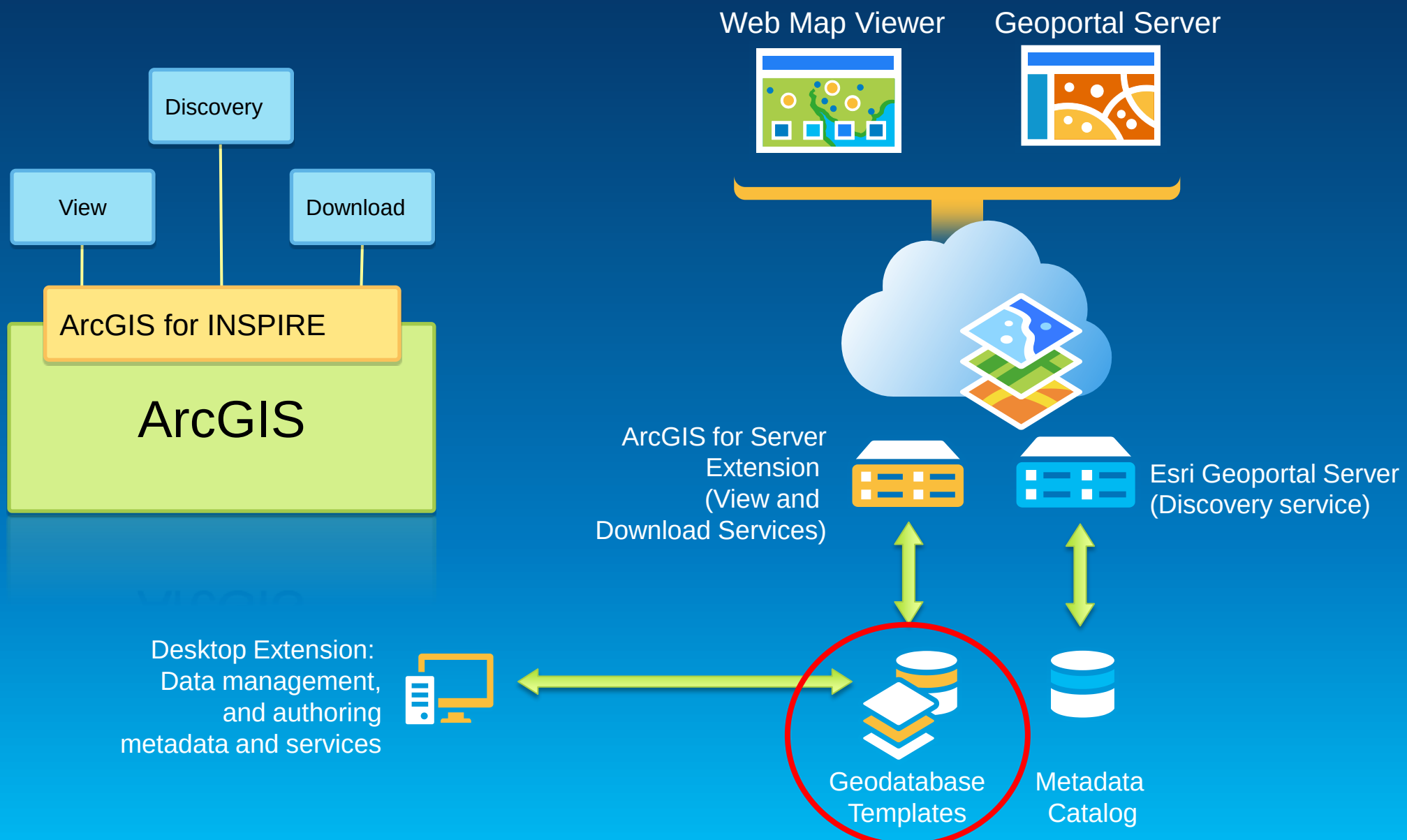
ArcGIS for INSPIRE Extends ArcGIS for EU INSPIRE compliance

Discovery Services, View Services, Download Services, Metadata, Data Models

ArcGIS For INSPIRE

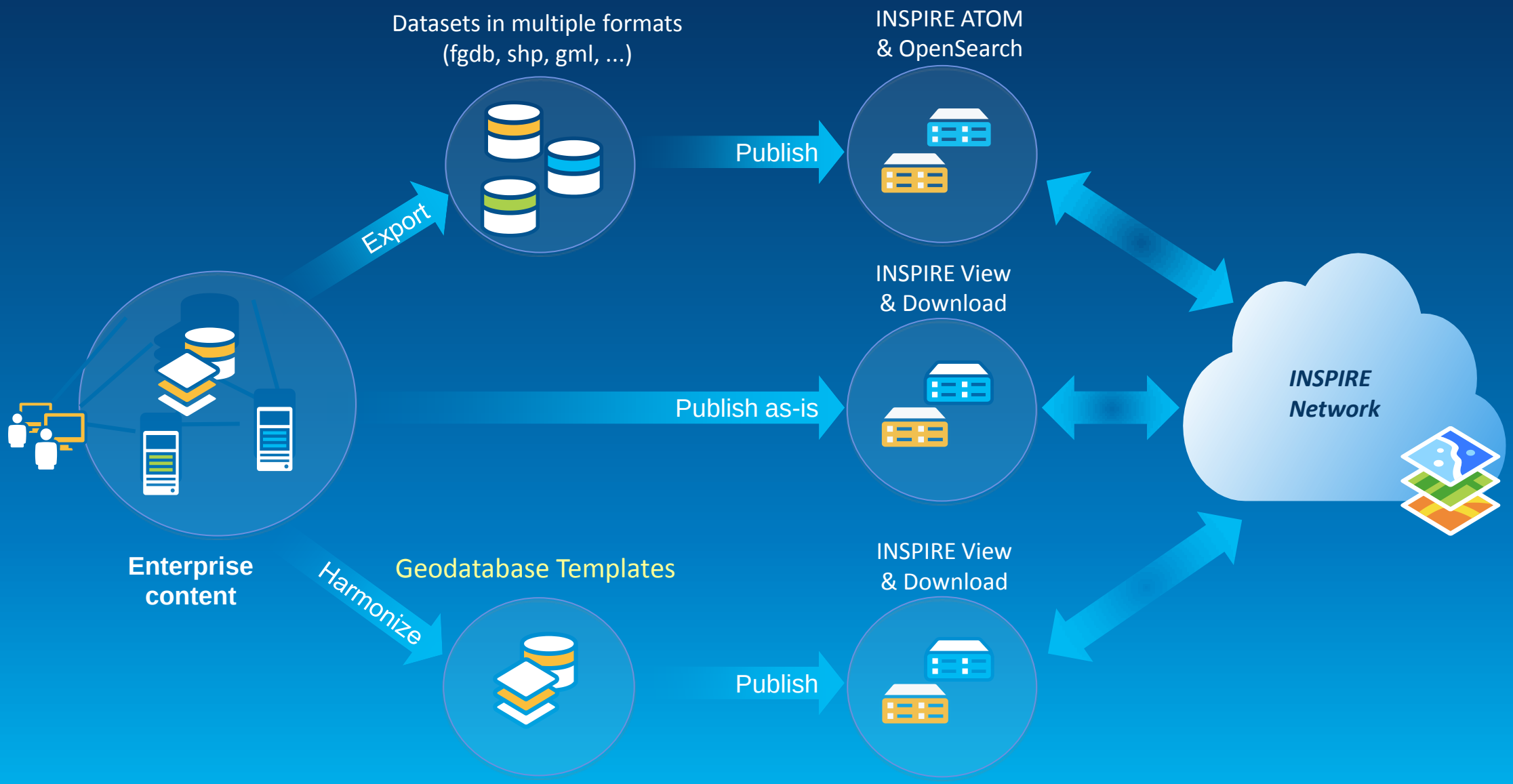
Enabling users to implement INSPIRE

ArcGIS for INSPIRE: what's included



ArcGIS for INSPIRE Implementation Patterns

From basic to full implementation



Annex I	Annex II	Annex III
Coordinate Reference System	Land Cover	Statistical Units
Geographical Grid System	Geology	Buildings
Geographical Names	Elevation	Soil
Administrative Units	Orthoimagery	Land Use
Addresses		Human Health and Safety
Cadastral Parcels		Utility and Governmental Services
Transport Networks		Environmental Monitoring Facilities
Hydrography		Production and Industrial Facilities
Protected Sites		Agricultural and Aquacultural Facilities
		Population Distribution - Demography
		Area Managements/Restriction/Regulation Zones and Reporting Units
		Natural Risk Zones
		Atmospheric Conditions
		Meteorological Geographical Features
		Oceanographic Geographical Features
		Sea Regions
		Bio-geographical Regions
		Habitats and Biotopes
		Species Distribution
		Energy Resources
		Mineral Resources

INSPIRE data themes

ArcGIS for INSPIRE provides geodatabase templates

Geodatabase Implementation for INSPIRE

- Started with INSPIRE UML, not GML Schema
  - So work from conceptual schema
  - Model reflects IR specs - not affected by downstream detail changes
- What goals? Designed to maximize the use of the data beyond just view:
  - Compliance tests
  - Quality Assurance
  - Cartography
  - Time-aware layers
  - REST services
  - Analysis
  - Extensible

Generating the physical Esri geodatabase Implementation

Annex I

- **For Annex I themes, all steps were automated**
  - **Resultant database good for INSPIRE services, but not optimal for analysis etc**

Generating the physical Esri geodatabase Implementation

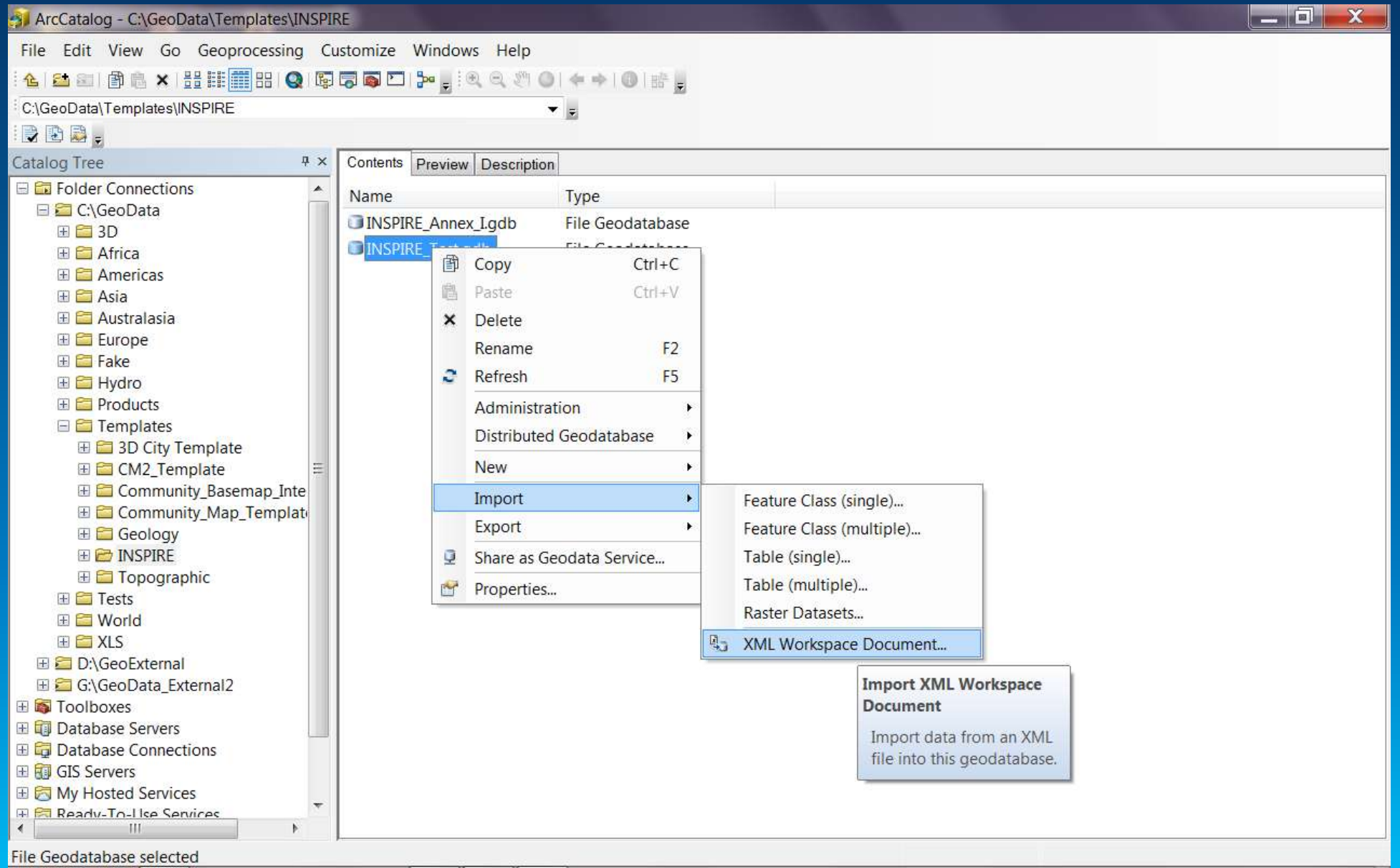
Annex II & III

- For Annex II & III themes (GE, LC), more options requiring human decisions
  - So step 1 was more manual, using Enterprise Architect
  - Resultant database is more useable by GIS functionality

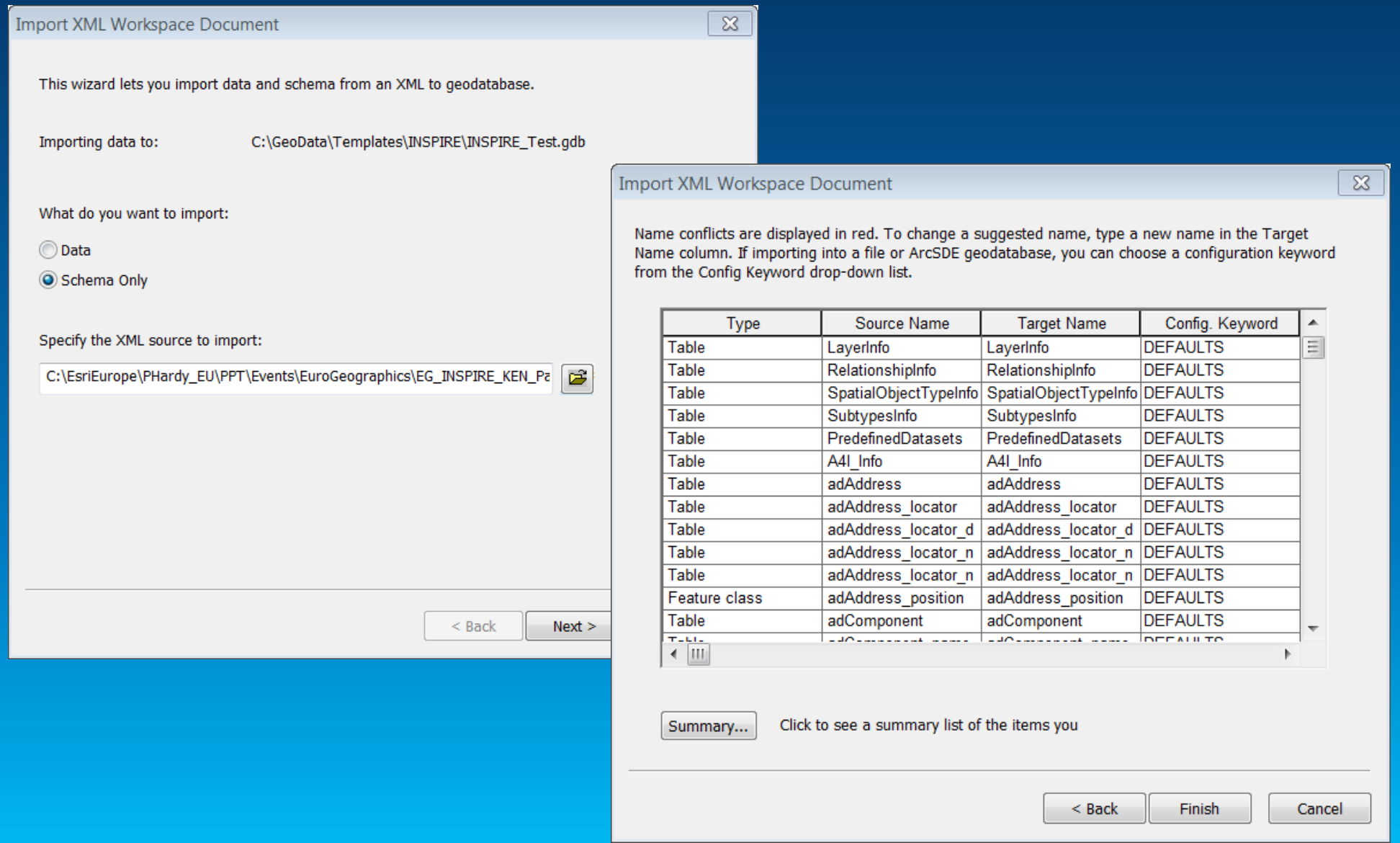
ArcGIS for INSPIRE – Schema XML

```
    </DataElement>
  - <DataElement xsi:type="esri:DEFeatureClass">
      <CatalogPath>/FC=auAdmBoundaryL</CatalogPath>
      <Name>auAdmBoundaryL</Name>
      <DatasetType>esriDTFeatureClass</DatasetType>
      <DSID>2</DSID>
      <Versioned>false</Versioned>
      <CanVersion>true</CanVersion>
      <HasOID>true</HasOID>
      <OIDFieldName>OBJECTID</OIDFieldName>
    - <Fields xsi:type="esri:Fields">
      - <FieldArray xsi:type="esri:ArrayOfField">
        - <Field xsi:type="esri:Field">
            <Name>OBJECTID</Name>
            <Type>esriFieldTypeOID</Type>
            <IsNullable>false</IsNullable>
            <Length>4</Length>
            <Precision>0</Precision>
            <Scale>0</Scale>
            <Required>true</Required>
            <Editable>false</Editable>
            <AliasName>Unique identifier</AliasName>
            <ModelName>OBJECTID</ModelName>
          </Field>
        - <Field xsi:type="esri:Field">
            <Name>IFCID</Name>
            <Type>esriFieldTypeInteger</Type>
            <IsNullable>false</IsNullable>
            <Length>4</Length>
            <Precision>0</Precision>
            <Scale>0</Scale>
            <Required>true</Required>
            <Editable>true</Editable>
            <AliasName>ArcGIS for INSPIRE identifier, used in references to the object/feature</AliasName>
            <ModelName>IFCID</ModelName>
          </Field>
        - <Field xsi:type="esri:Field">
            <Name>SHAPE</Name>
            <Type>esriFieldTypeGeometry</Type>
```

ArcGIS for INSPIRE – Installing schema template



ArcGIS for INSPIRE – Installing schema template …cont

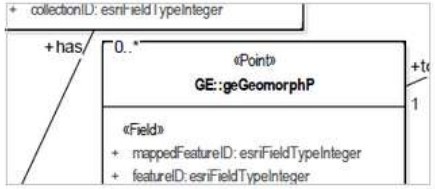


ArcGIS for INSPIRE Help on Geodatabase Templates

ArcGIS for INSPIRE

Current Version: 10.3 **Released:** December 2014

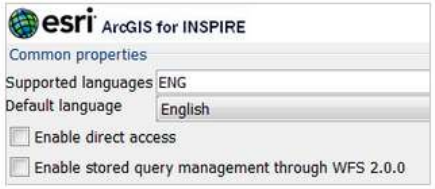
ArcGIS for INSPIRE is the solution for preparation of harmonized spatial data via standardized services pursuant to the guidelines of the INSPIRE specification. It provides mechanisms to efficiently store transformed data and distribute service-based data via the INSPIRE View and Download services.



Implement INSPIRE Data Models

Geodatabase templates, which implement the INSPIRE data specifications, are provided as part of the solution. An essential element of INSPIRE is the data model specification that provides a uniform way to view and download geographic datasets shared in the INSPIRE network by European Member States.

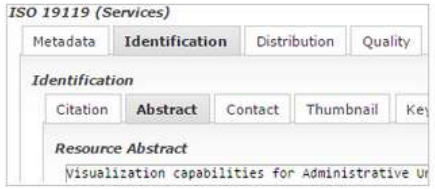
ArcGIS for INSPIRE geodatabase templates >



Publish INSPIRE Services

Author maps and publish View and Download services compliant with INSPIRE specifications.

Create INSPIRE services >



Share, Discover, and Consume INSPIRE Resources

Geoportal allows you to create, manage, and use INSPIRE compliant metadata, expose metadata via INSPIRE Discovery services, and create and customize metadata profiles to meet additional national requirements.

Not Ready for Data Harmonization?

ArcGIS for INSPIRE enables you to deliver INSPIRE View and Download services for non-harmonized data. Discover how you can add non-INSPIRE data to a map. and create feature download services and predefined dataset services with as is data.

Link

Available in multiple languages

ArcGIS for INSPIRE Template HTML Data Dictionary

lc_datadictionary.Htm

file:///C:/Downloads/Esri/A4I_10_3/GDB%20Templates/LC/lc_datadictionary.Htm

Data Dictionary for INSPIRE Land Cover Theme

The geodatabase template for Land Cover implements the INSPIRE LandCoverNomenclature schema and LandCoverVector schema within the Land Cover Theme, LandCoverRaster schema is not included yet.

To view the geodatabase model diagram, please refer to lc_model.pdf.

Feature Datasets and Feature Classes

LC - Feature Dataset

lcvLandCoverDataset
lcvLandCoverUnitP
lcvLandCoverUnitS

Tables

lcnLandCoverNomenclature
lcvLandCoverValueP
lcvLandCoverValueS

Relationship Classes

lcvDataset_UnitP
lcvDataset_UnitS
lcvNomenclature_Dataset
lcvUnitP_ValueP
lcvUnitS_ValueS

Domains

PartyRole
VoidReasonValue

LC - FeatureDataset

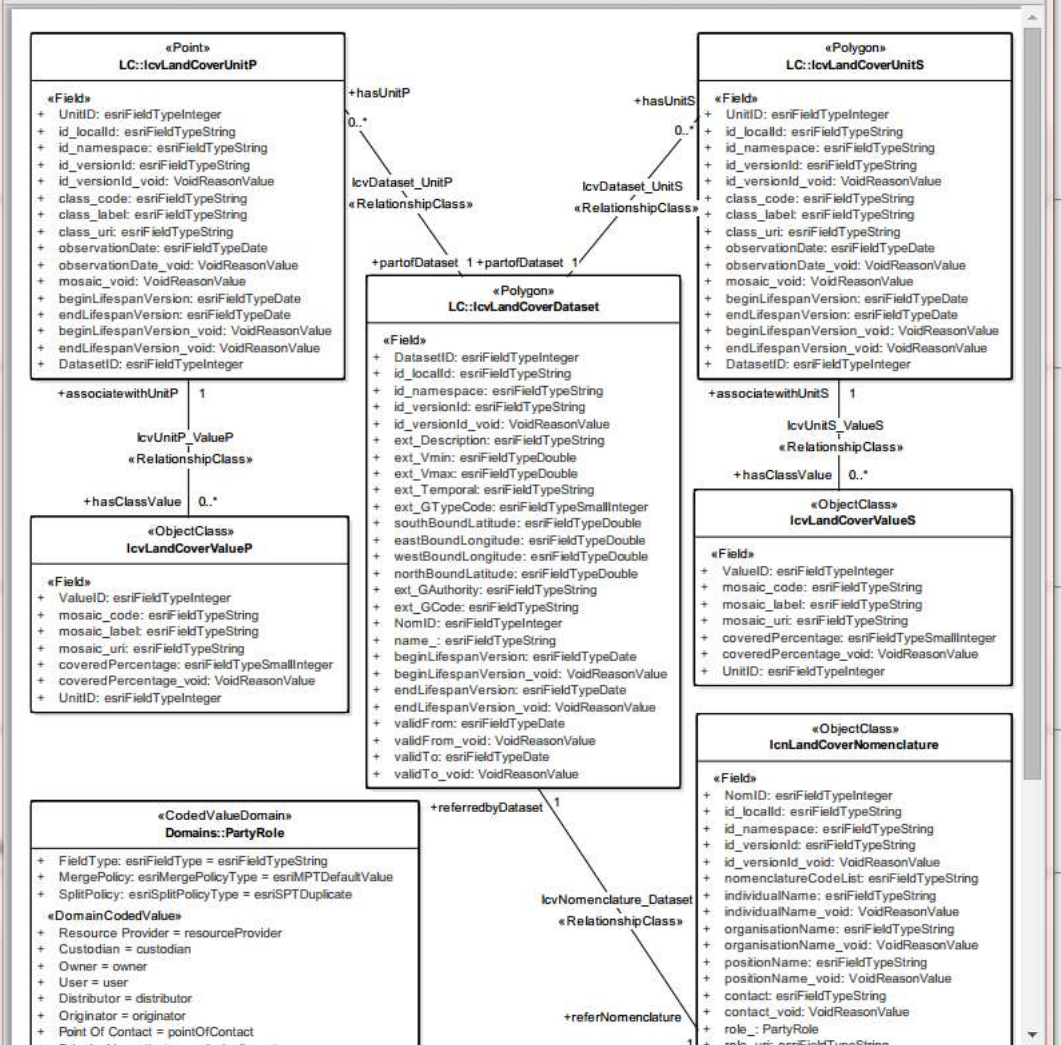
Name	LC
Description	This section contains feature clas

lcvLandCoverDataset - FeatureClass

Name	lcvLandCoverDataset
ShapeType	Polygon
FeatureType	Simple
HasM	false

lc_model.pdf

file:///C:/Downloads/Esri/A4I_10_3/GDB%20Templates/LC/lc_model.pdf



Mapping INSPIRE schema to Geodatabase schema

- To Feature Class if object has geometry, object class if not
  - Single geometry type, so mixed geometry to xxxP, xxxL, xxxS
- Names limited to 30 characters
  - AdministrativeUnits::AdministrativeUnit becomes auAdmUnitS
- Attributes with a maximum multiplicity greater than one are converted into their own object class.
  - Attribute values are associated through foreign key references (fields RID to IFCID).
  - Attribute “name” of AdministrativeUnits::AdministrativeUnit is converted to the object class auAdmUnitS_name
- Attributes that are voidable have additional field with the suffix “_void” to distinguish unknown/unpopulated/missing
- Code Lists -> database domains + URL of reference list
- …

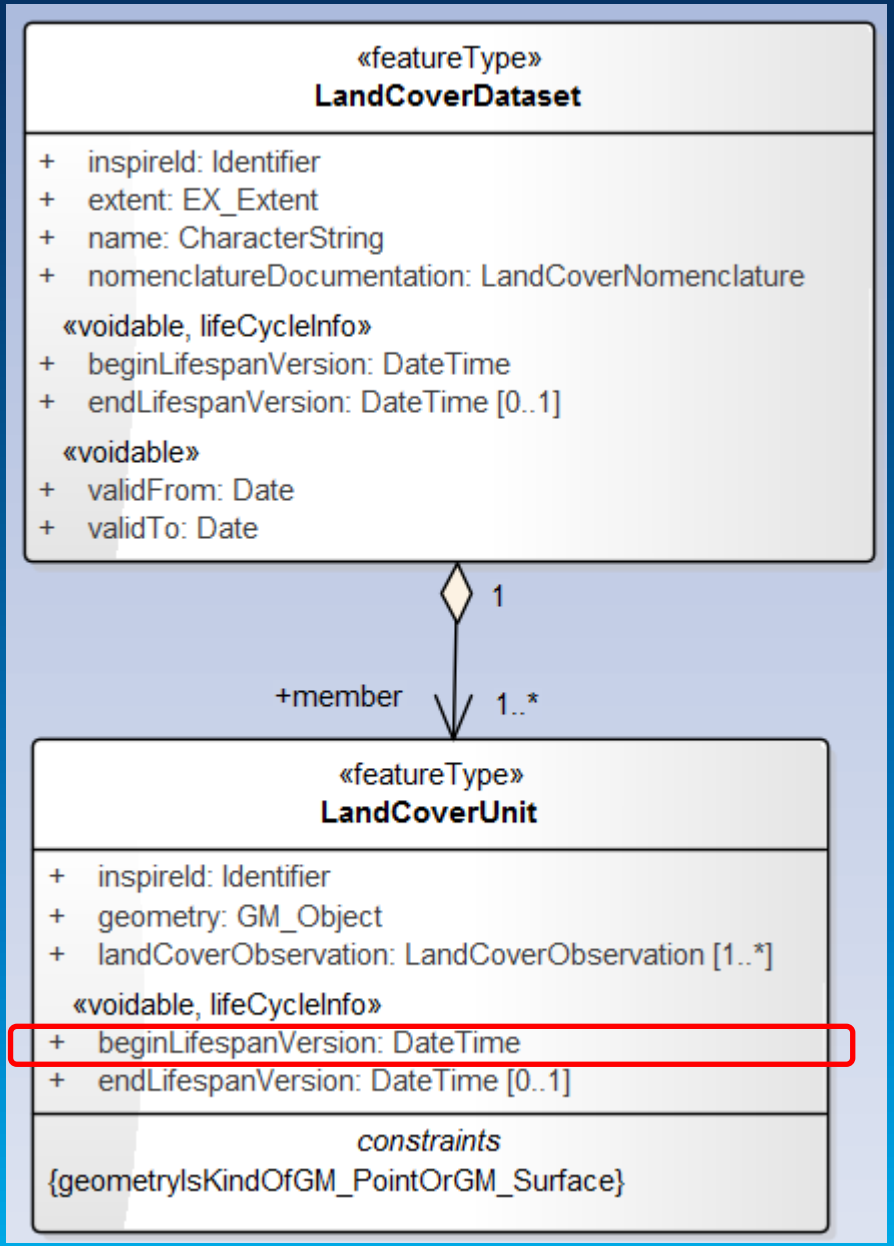
Data themes - Dependencies and extensibility

- **Dependencies: a data theme may depend on others:**
  - **Mineral resources requires geology data theme, the UML and geodatabase implementation must consider this dependency**
  - **Annex I themes use common structures (network node)**

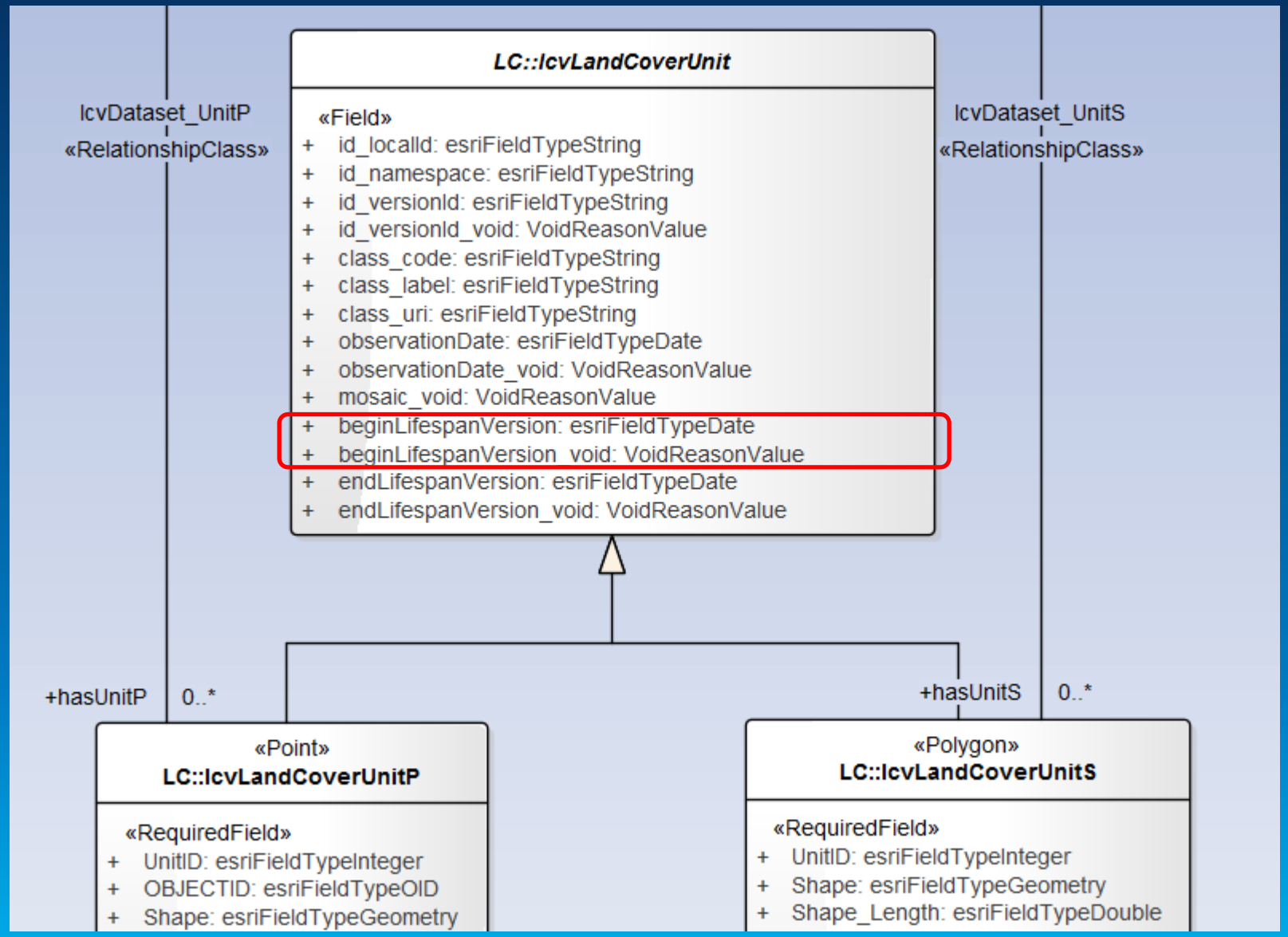
- **Template versions and profiles**
  - **INSPIRE Annex II/III introduced the concept of profile**
  - **ELF can be seen as a profile of INSPIRE**

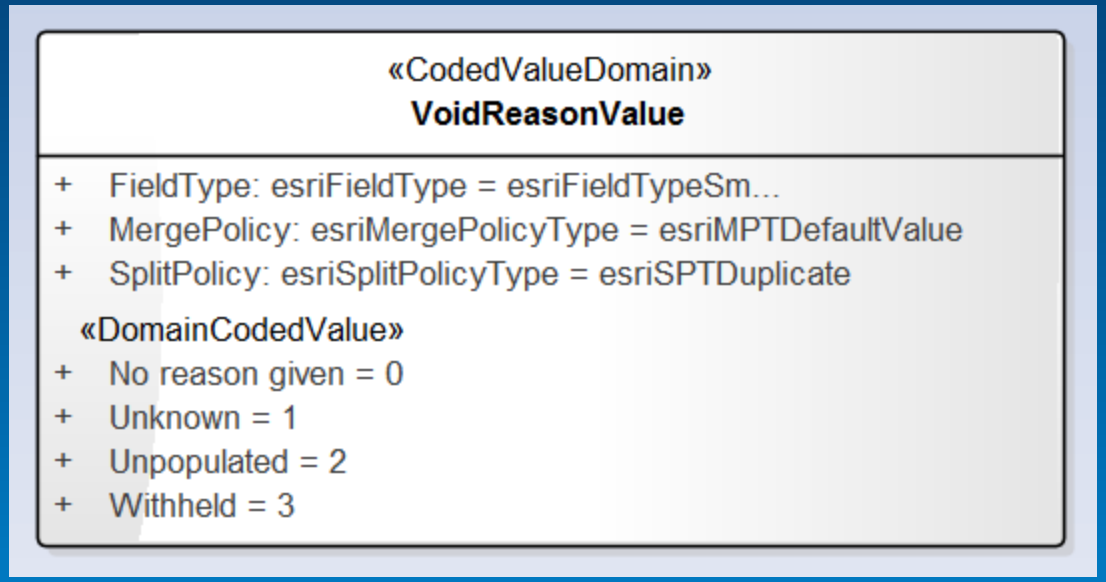
- **Data encoding and services**
  - **INSPIRE GML application schemas + WFS 2.0 for INSPIRE download services**
  - **ATOM-based download services meet user expectations and early INSPIRE compliance**
  - **Beyond INSPIRE - Esri REST services (e.g. data reviewer, online/off-line editing, analysis)**

ISO INSPIRE UML model

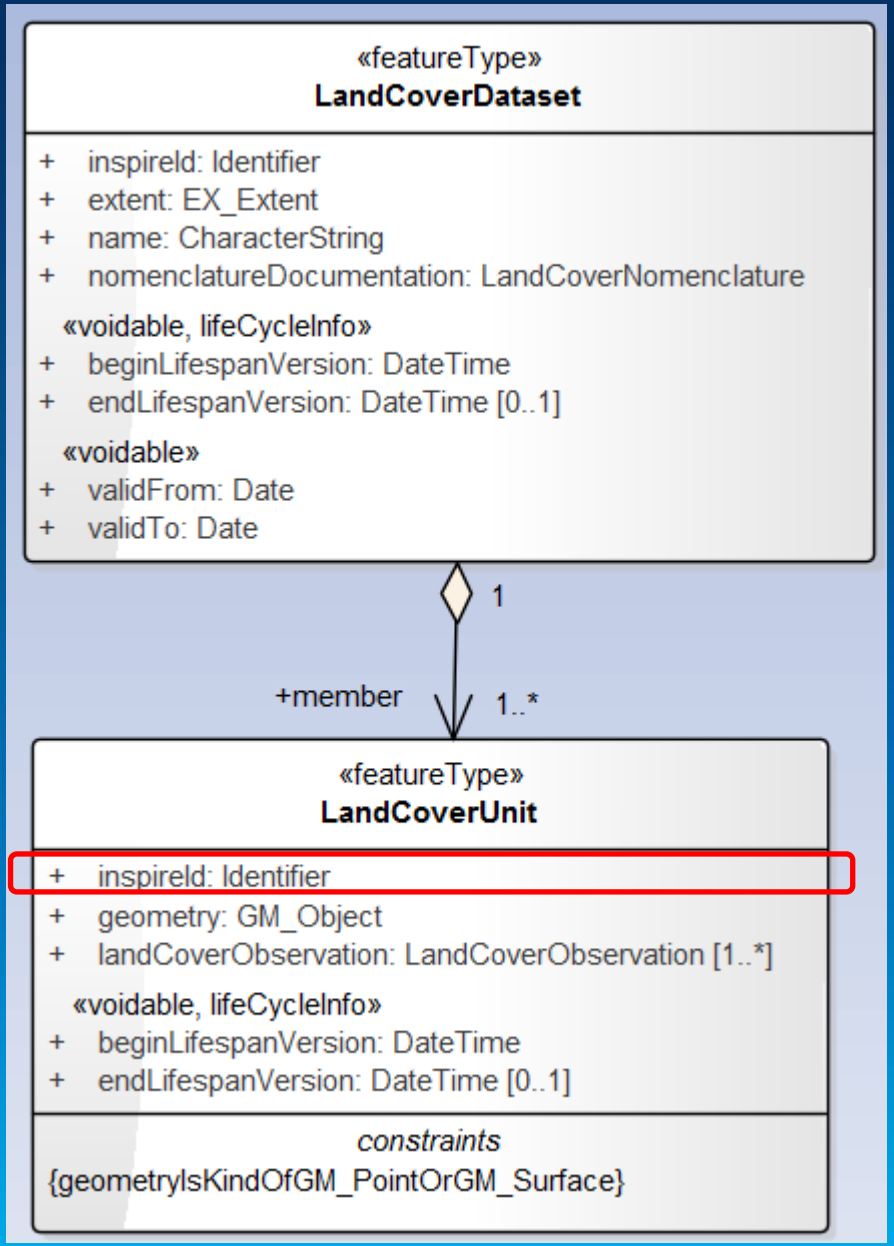


Esri Geodatabase Implementation in UML

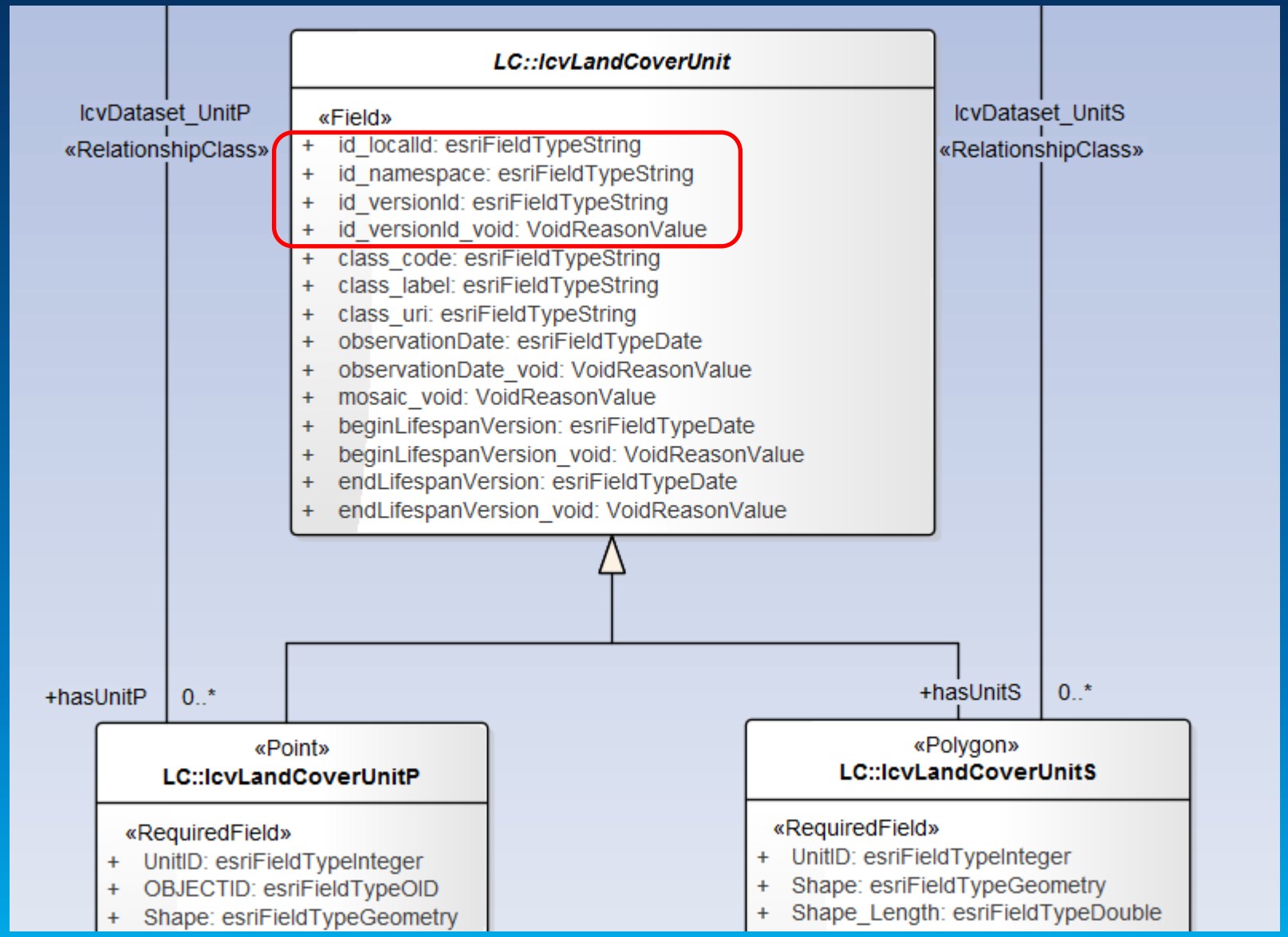



«CodedValueDomain»
VoidReasonValue
+ FieldType: esriFieldType = esriFieldTypeSm...
+ MergePolicy: esriMergePolicyType = esriMPTDefaultValue
+ SplitPolicy: esriSplitPolicyType = esriSPTDuplicate
«DomainCodedValue»
+ No reason given = 0
+ Unknown = 1
+ Unpopulated = 2
+ Withheld = 3

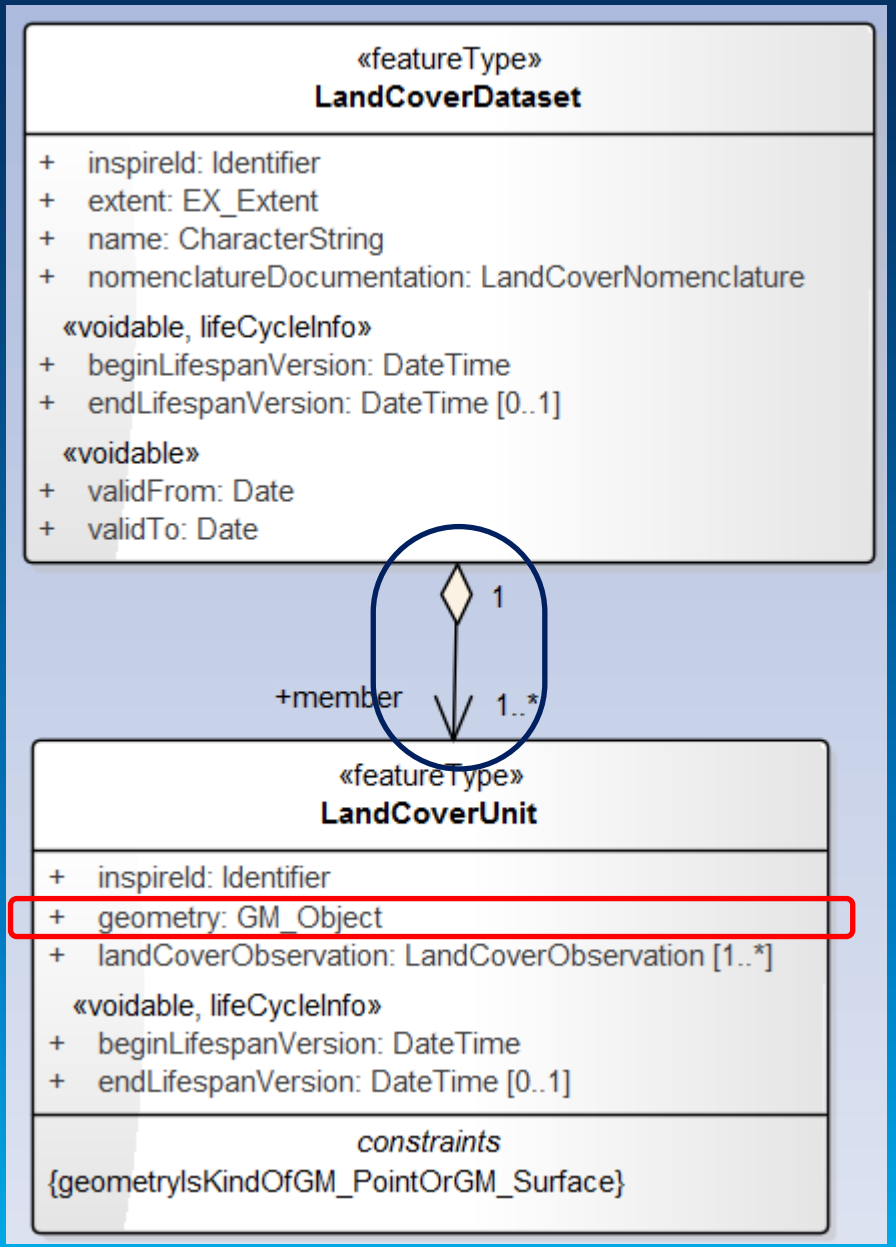
ISO INSPIRE UML model



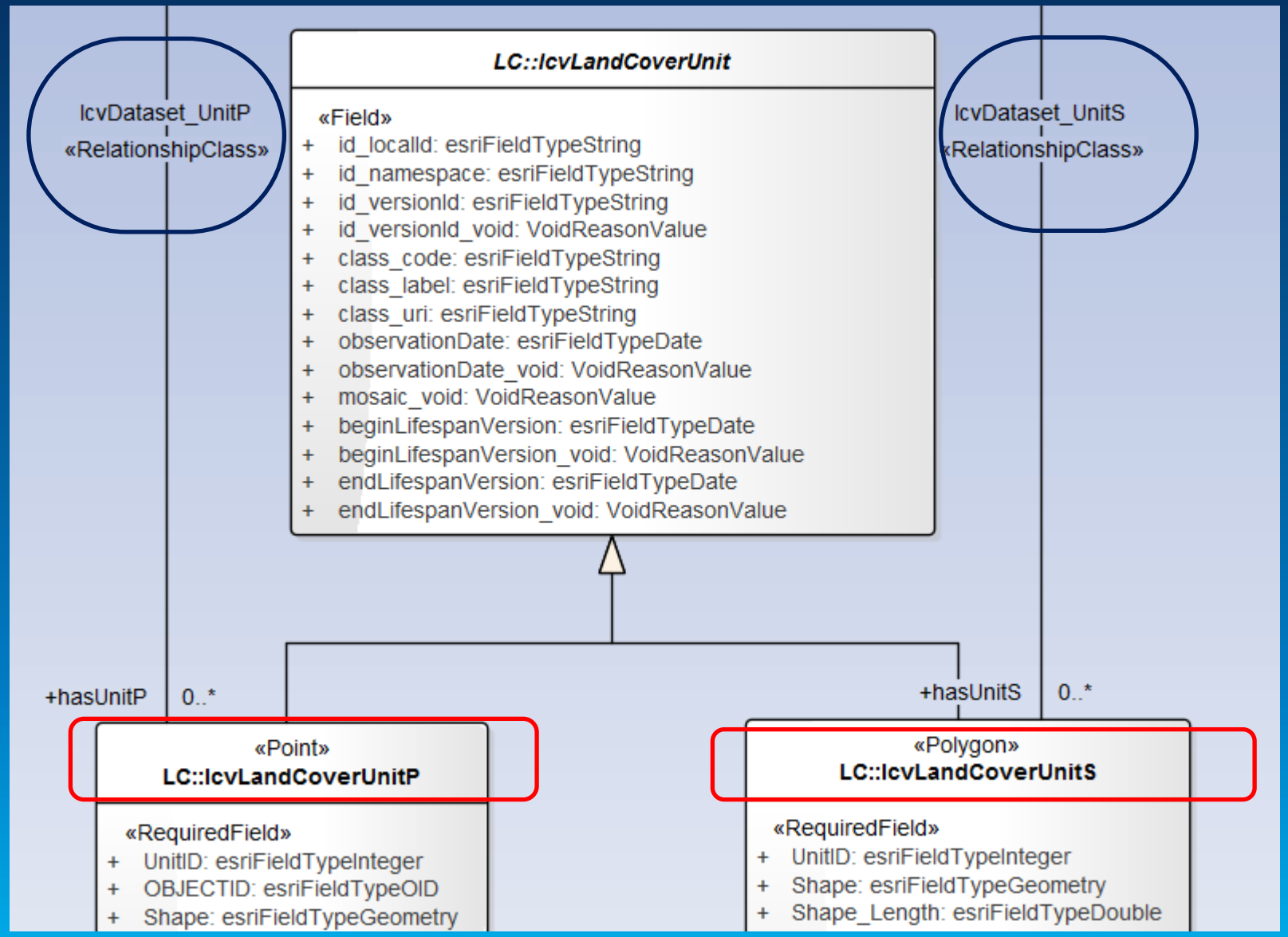
Esri Geodatabase Implementation in UML



ISO INSPIRE UML model



Esri Geodatabase Implementation in UML

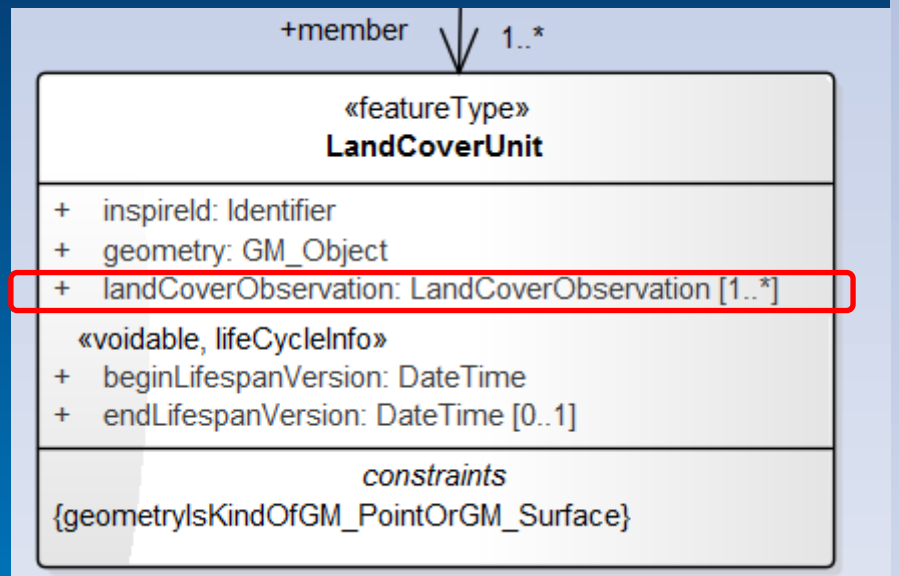


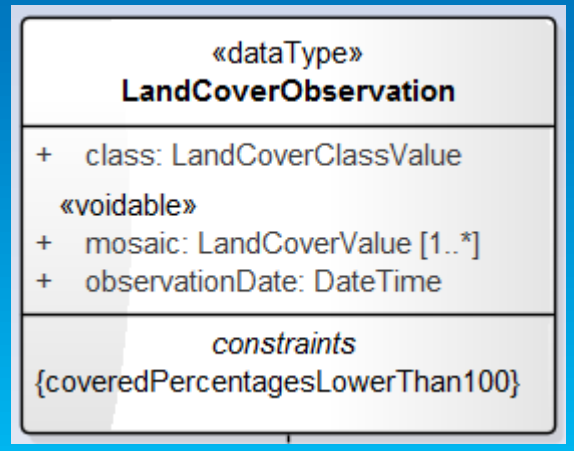
11.3 Styles recommended to be supported by INSPIRE view services

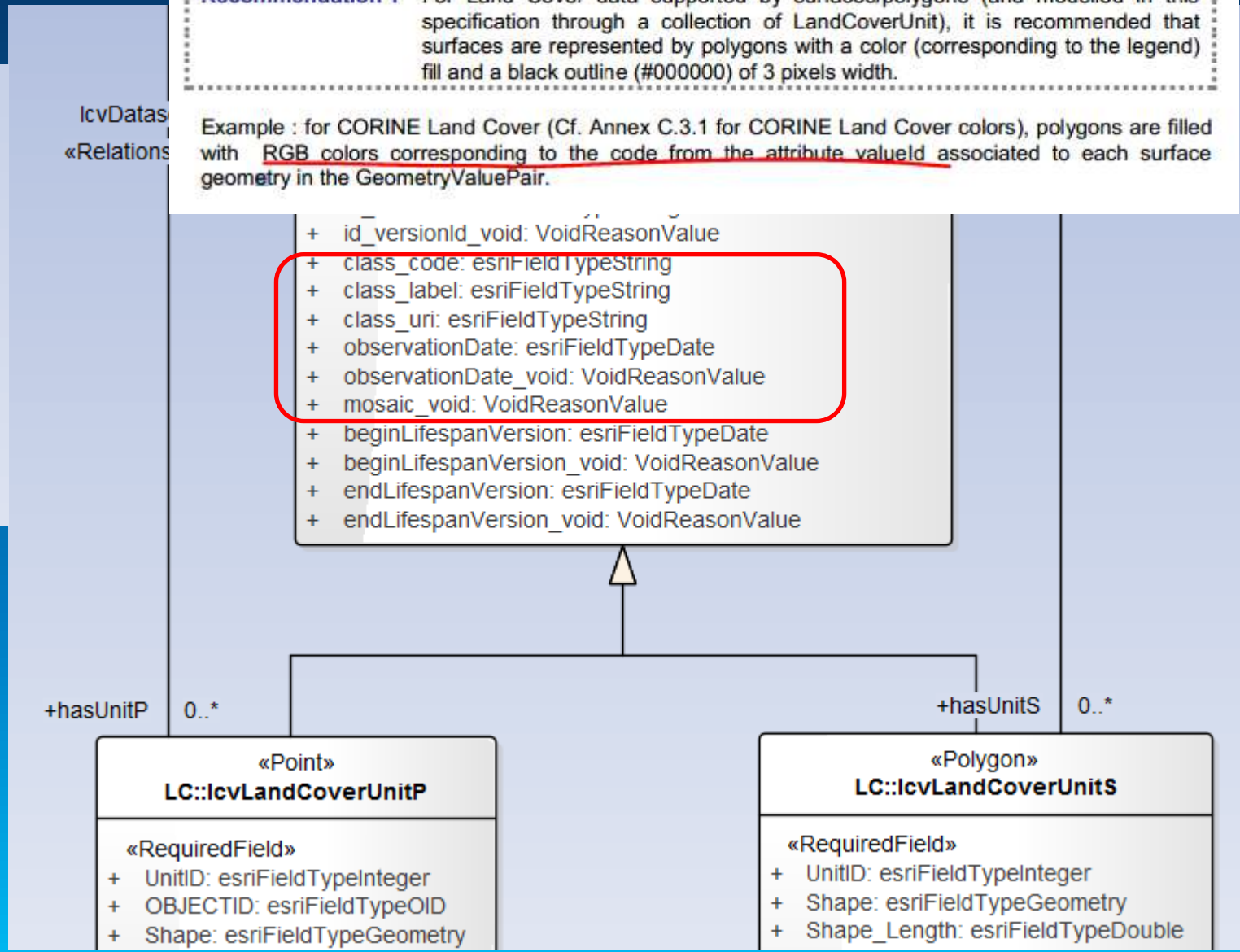
As this specification is generic and does not require the usage of a specific nomenclature, the previous default styles only represent the geometries supporting Land Cover information and not the information itself. It is however recommended that WMS servers implement styles that allow :

Recommendation 1 For Land Cover data supported by surfaces/polygons (and modelled in this specification through a collection of LandCoverUnit), it is recommended that surfaces are represented by polygons with a color (corresponding to the legend) fill and a black outline (#000000) of 3 pixels width.

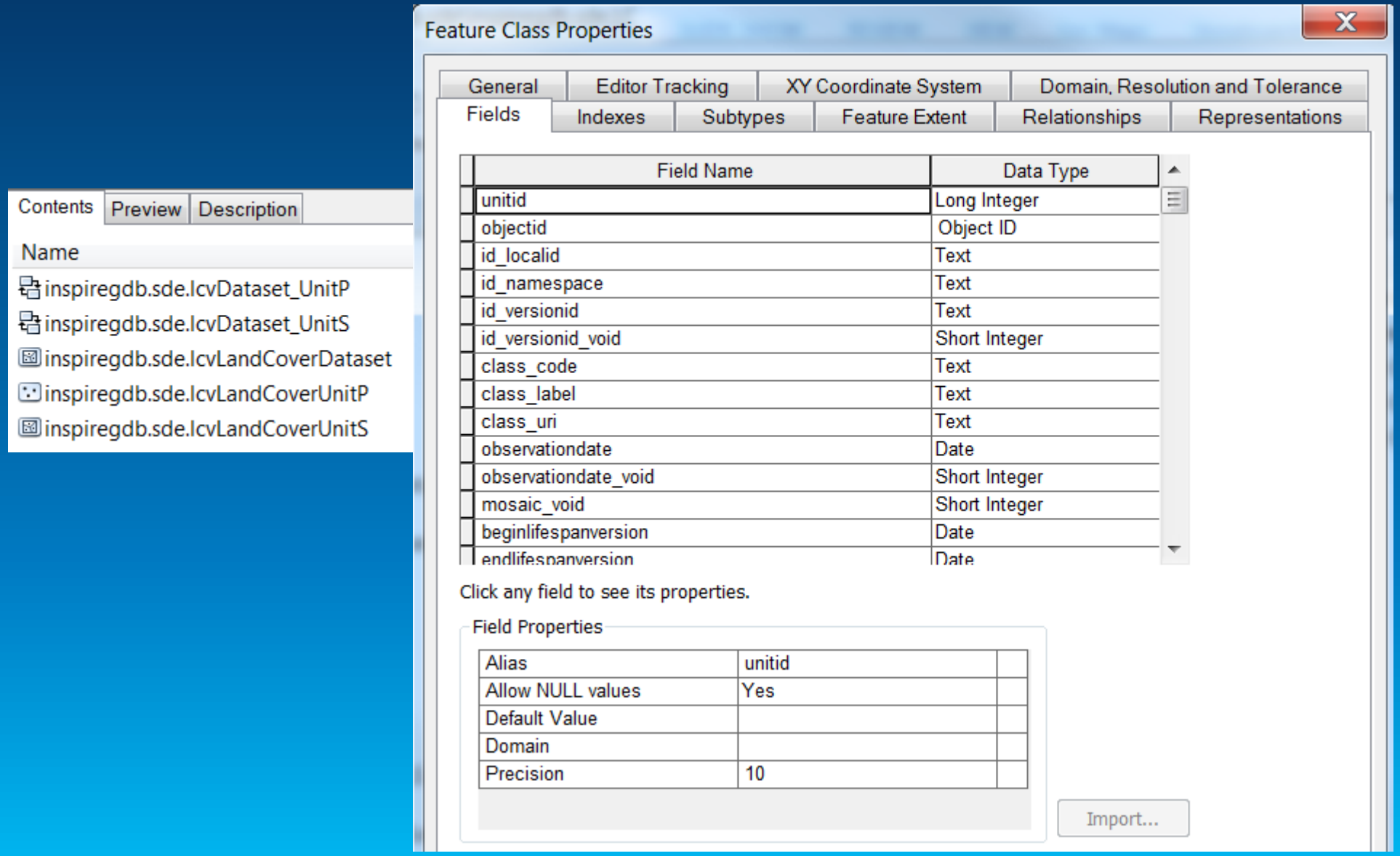
Example : for CORINE Land Cover (Cf. Annex C.3.1 for CORINE Land Cover colors), polygons are filled with RGB colors corresponding to the code from the attribute valueId associated to each surface geometry in the GeometryValuePair.







Esri geodatabase in ArcGIS systems

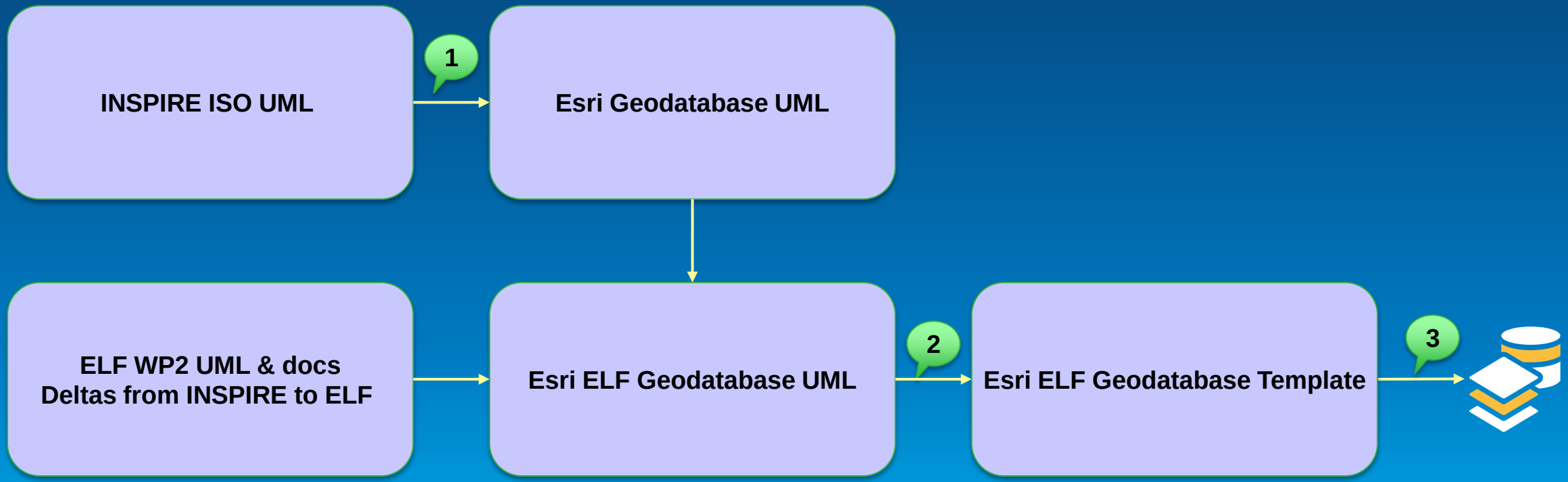


INSPIRE-ELF Gap Analysis

- Gap categorized in
  - No differences
  - Extensions of existing INSPIRE objects
  - New features not existing in INSPIRE

Generating the physical Esri geodatabase Implementation

With ELF additions and changes



applying just the changes from INSPIRE to ELF Schema to the GDB UML

rlucchi@esri.com