GIS Data Models for INSPIRE and ELF

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Data Modelling and Model Driven Implementation of Data Distribution
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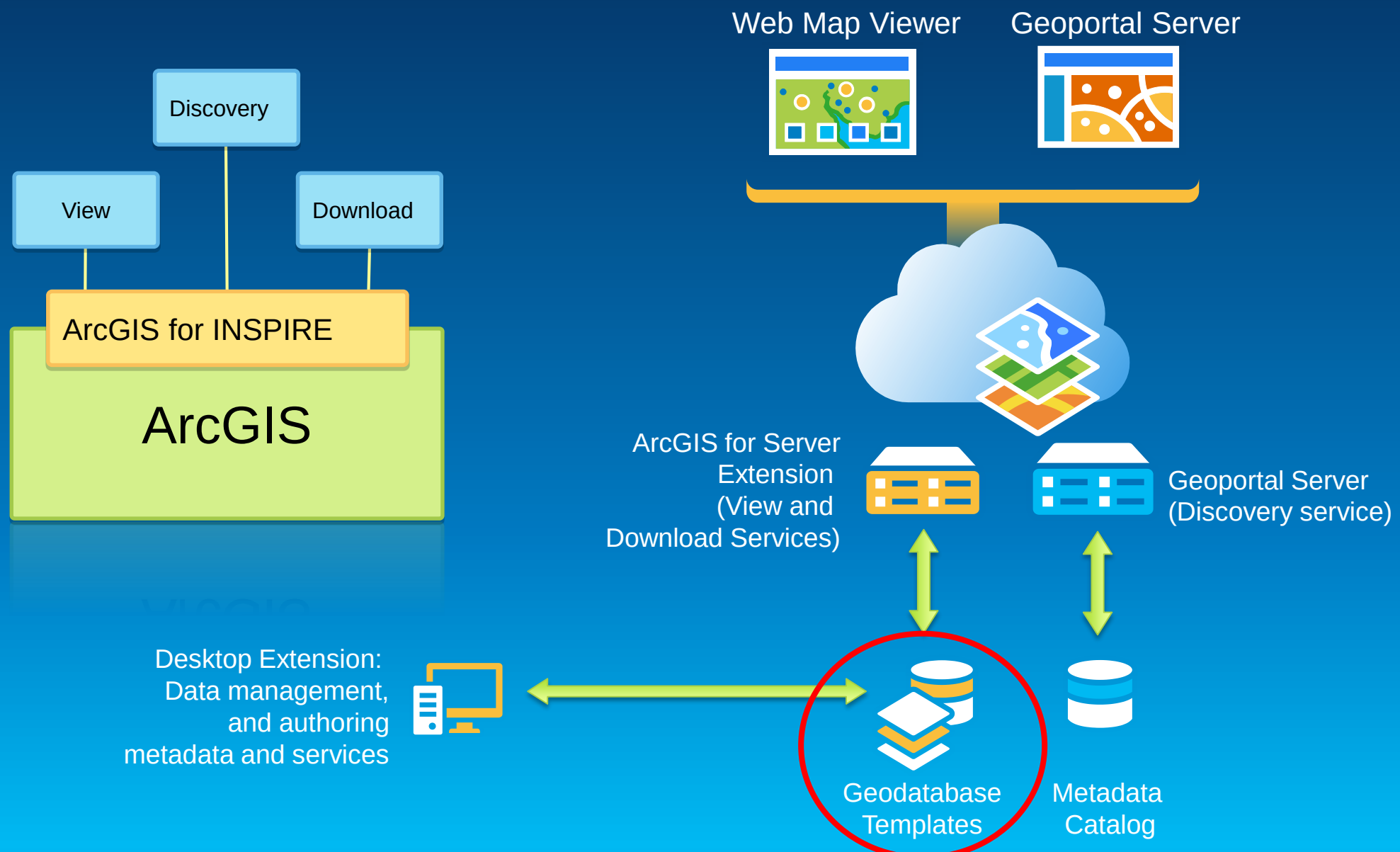
ArcGIS for INSPIRE Extends ArcGIS for EU INSPIRE compliance

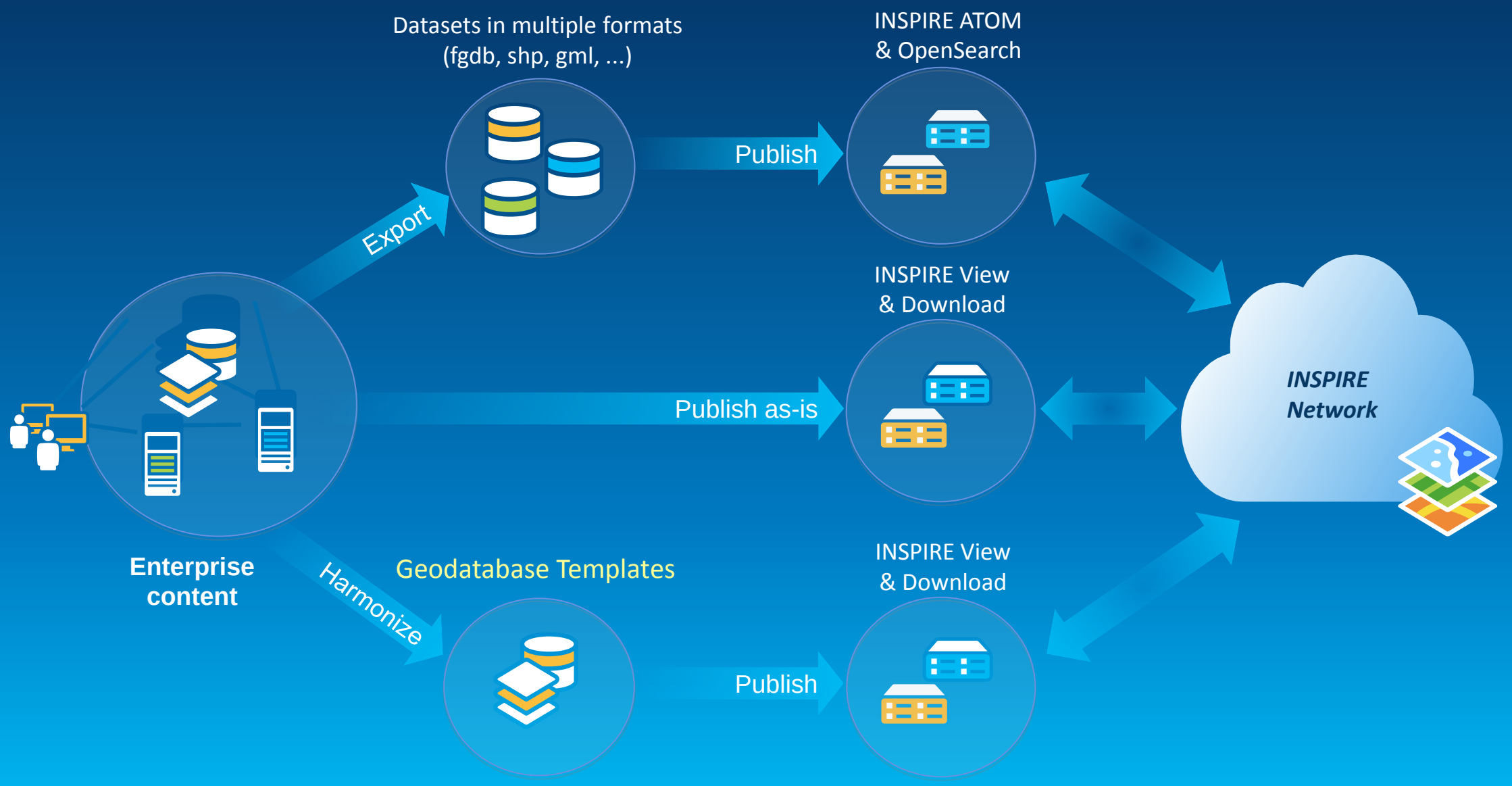
Discovery Services, View Services, Download Services, Metadata, Data Models

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

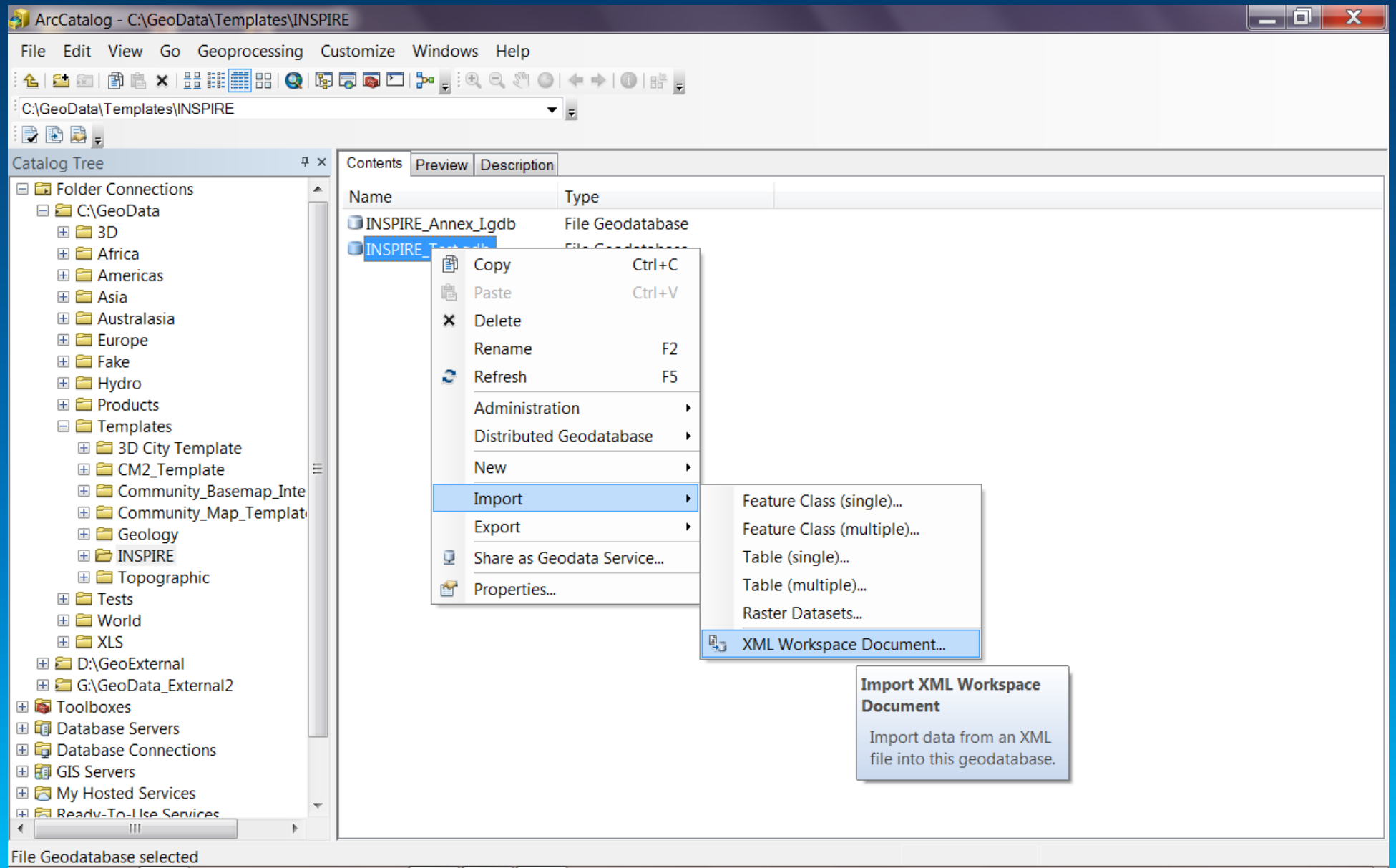
Annex II & III

- 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

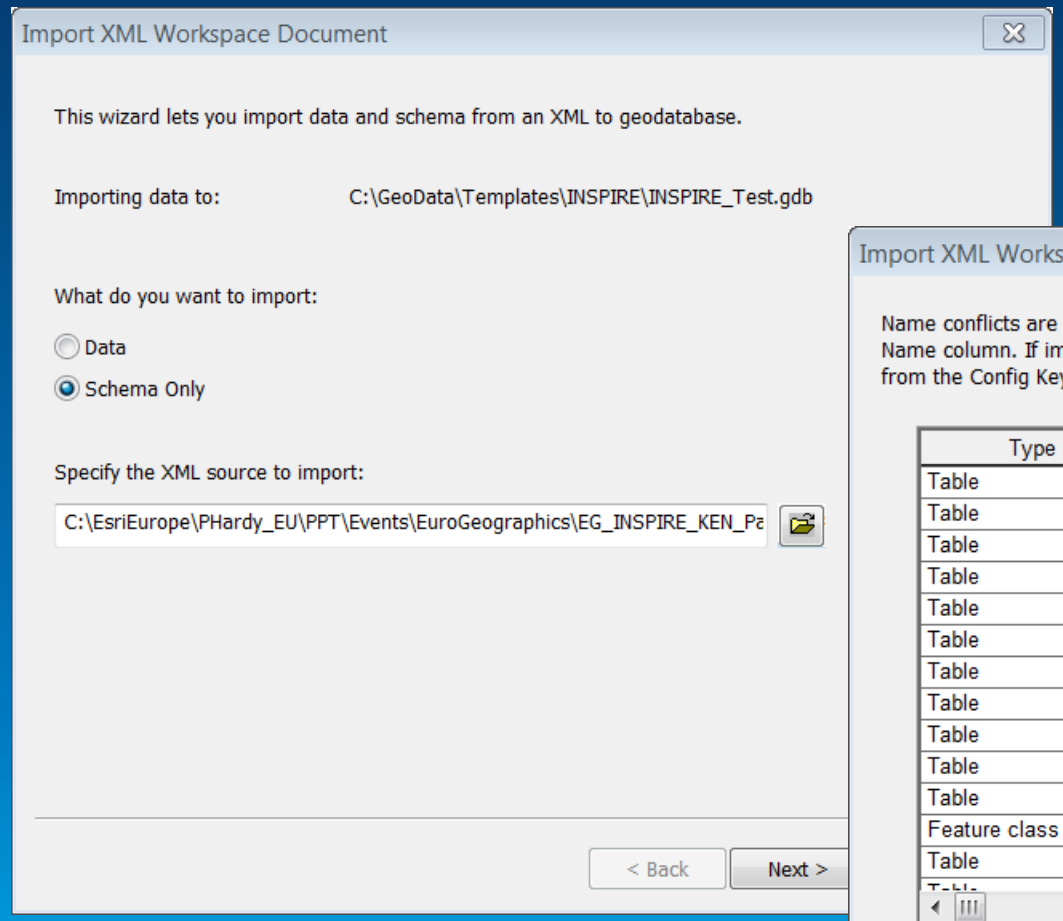
ArcGIS for INSPIRE – Schema XML

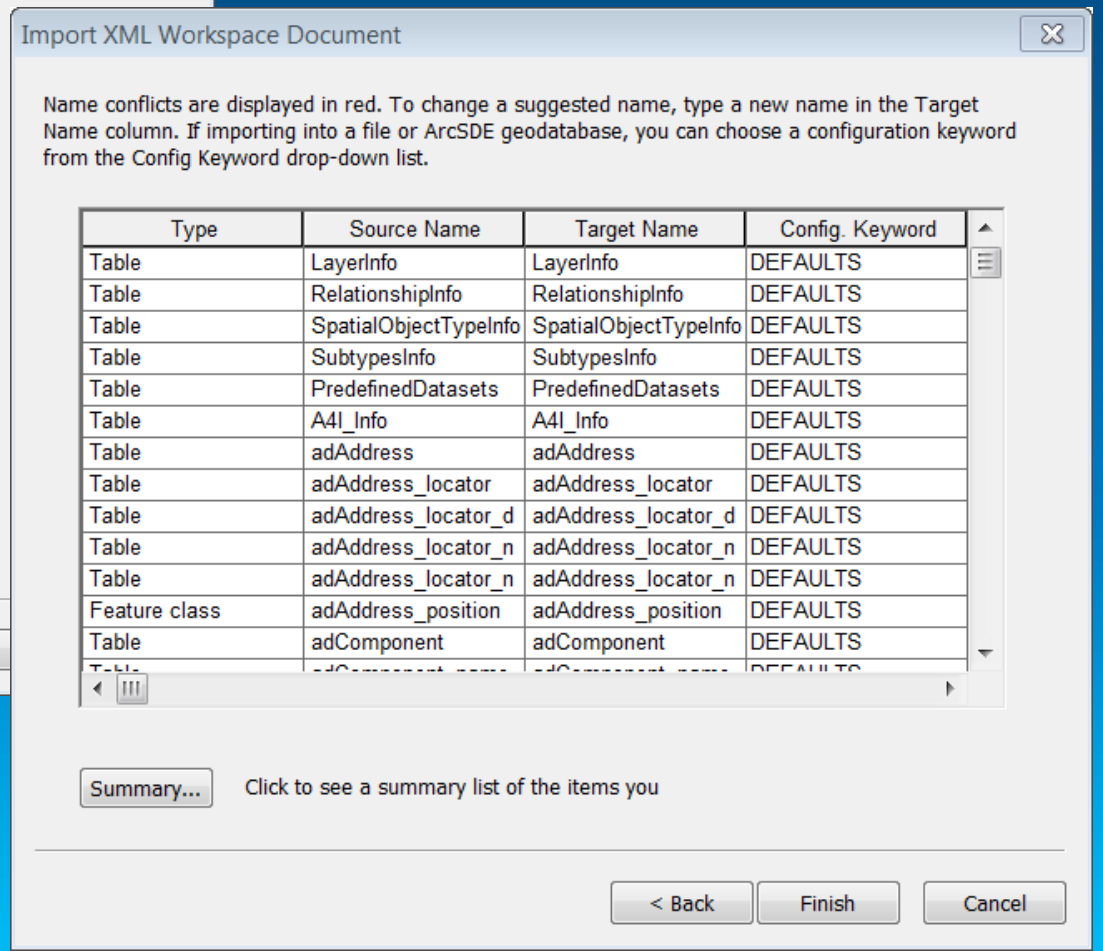

```
    </DataElement>
  - <DataElement xsi:type="esri:DEFeatureClass">
      <CatalogPath>/FC=auAdmBoundaryL</CatalogPath>
      <Name>auAdmBoundaryL</Name>
      <DatasetType>esriDTFeatureClass</DatasetType>
      <DSID>2</DSID>
      <Versioned>false</Versioned>
      <CanVersion>true</CanVersion>
      <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





Type	Source Name	Target Name	Config. Keyword
Table	LayerInfo	LayerInfo	DEFAULTS
Table	RelationshipInfo	RelationshipInfo	DEFAULTS
Table	SpatialObjectTypeInfo	SpatialObjectTypeInfo	DEFAULTS
Table	SubtypesInfo	SubtypesInfo	DEFAULTS
Table	PredefinedDatasets	PredefinedDatasets	DEFAULTS
Table	A4I_Info	A4I_Info	DEFAULTS
Table	adAddress	adAddress	DEFAULTS
Table	adAddress_locator	adAddress_locator	DEFAULTS
Table	adAddress_locator_d	adAddress_locator_d	DEFAULTS
Table	adAddress_locator_n	adAddress_locator_n	DEFAULTS
Table	adAddress_locator_n	adAddress_locator_n	DEFAULTS
Feature class	adAddress_position	adAddress_position	DEFAULTS
Table	adComponent	adComponent	DEFAULTS

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
- …

ArcGIS for INSPIRE Help on Geodatabase Templates

http://resources.arcgis.com/ ArcGIS for INSPIRE -...

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- Welcome to ArcGIS for INSPIRE
- What is ArcGIS for INSPIRE
- System Requirements
- Release Notes
- Server Components
- Desktop Components
  - ArcGIS for INSPIRE Deskto
  - CSW Clients
  - Publish Client
  - WMC Client
- Geodatabase Template
  - Geodatabase Template
- Use Cases
- ArcGIS for INSPIRE Localisation
- Getting Assistance

Basic rules for the INSPIRE Geodatabase implementation

The conversion of the INSPIRE application schemas in the geodatabase follows encoding rules that guarantee INSPIRE data can be fully represented i INSPIRE Geodatabase. Since Esri geodatabases do not have native support for several modelling constructs used in the ISO 19100 and INSPIRE mod product-specific encoding rule is applied. The focus of the conversion is direct support for providing access to the data via INSPIRE network services. In section, the main encoding rules are listed and discussed.

Rule	Examples
An INSPIRE spatial object is typically represented as a feature class in the geodatabase. In cases where a spatial object does not have a geometry property, an object class is used instead.	The INSPIRE spatial object type ***AdministrativeUnits::AdministrativeUnit*** is stored in the geodatabase in the feature class ***auAdmUnitS***. The INSPIRE spatial object type ***Addresses::Address*** is stored in the geodatabase in the object class ***adAddress***.
Names of feature classes, object classes, and fields are limited to 30 characters in the geodatabase. There is no such limit in the INSPIRE application schemas. The names from the application schemas are therefore typically shortened in the geodatabase. To simplify the mapping between the names and to guarantee uniqueness, all names in the geodatabase start with the short code of the application schema that contains the type.	The INSPIRE spatial object type ***AdministrativeUnits::AdministrativeUnit*** is stored in the geodatabase in the feature class ***auAdmUnitS***. The short code for the application schema "AdministrativeUnits" is "au".

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

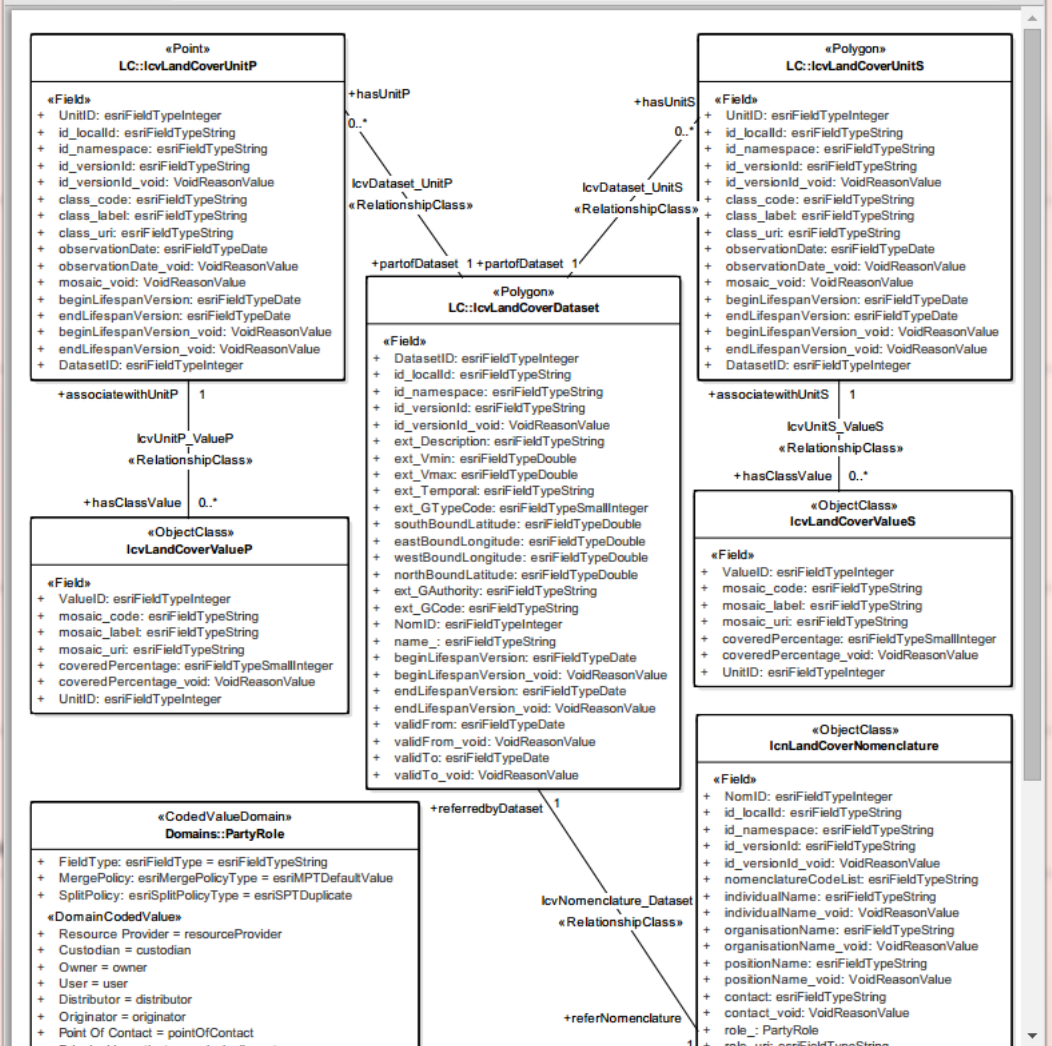
Name	LC
Description	This section contains feature clas

lcvLandCoverDataset - FeatureClass

Name	lcvLandCoverDataset
ShapeType	Polygon
FeatureType	Simple

lc_model.pdf

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



Link

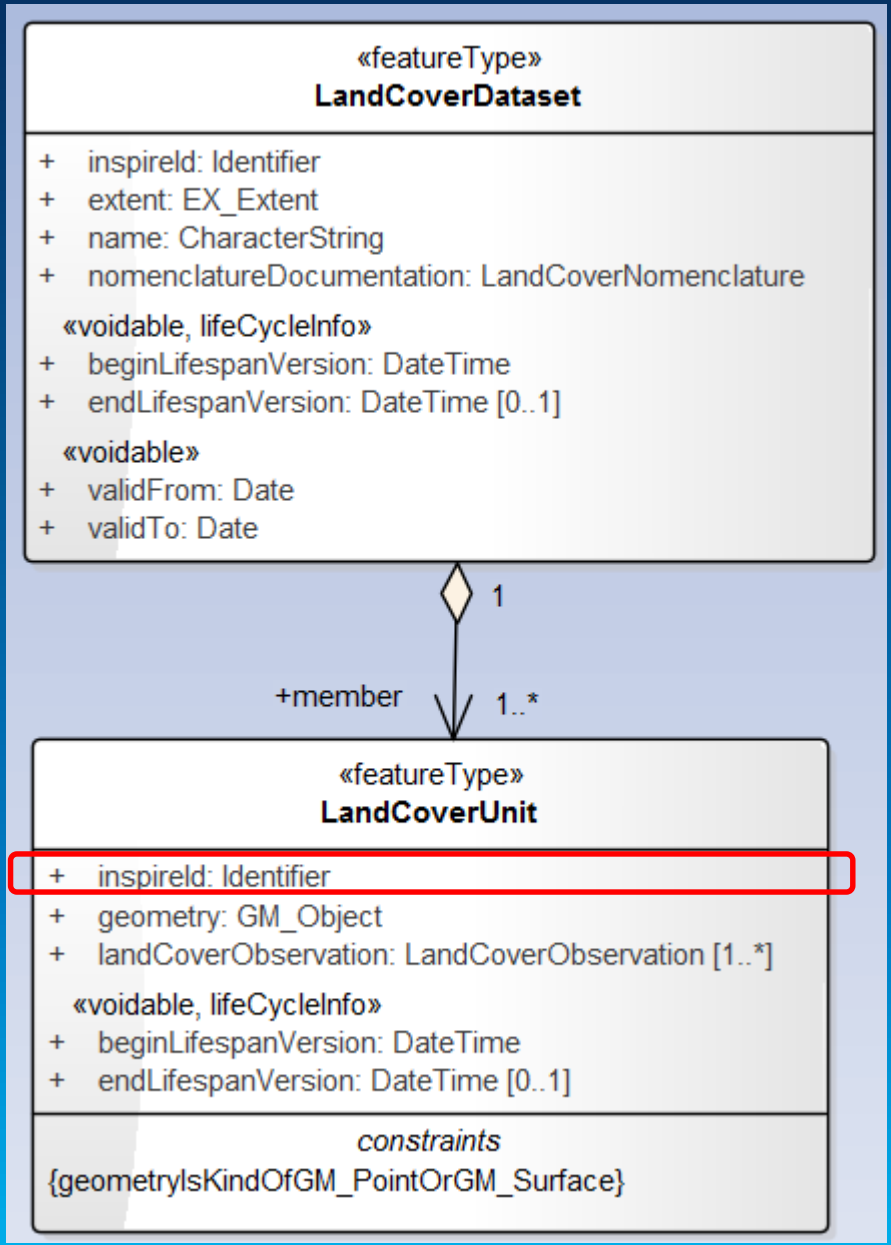
Data themes - Dependencies and extensibility

- 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)

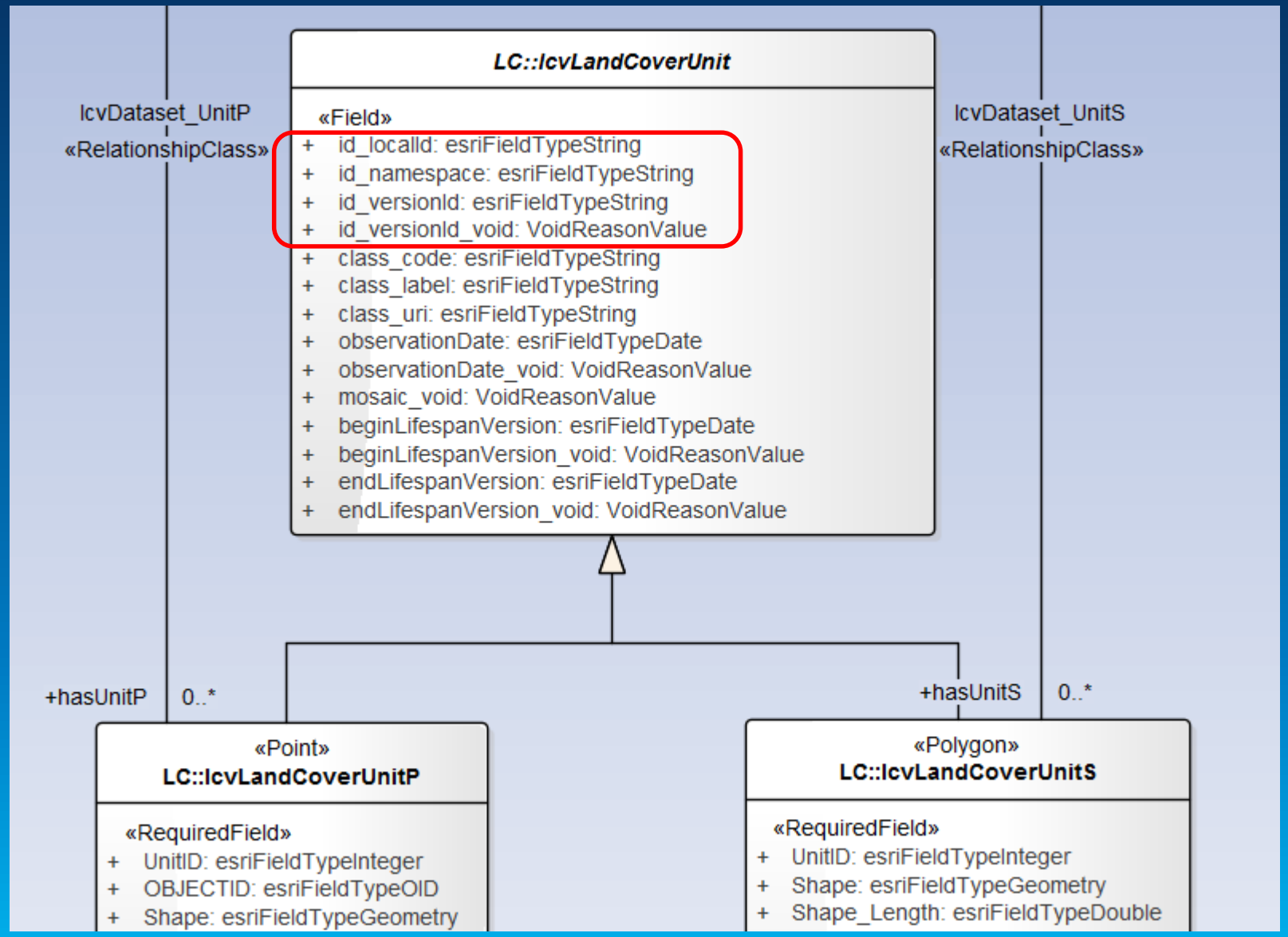
- Template versions and profiles
  - INSPIRE Annex II/III introduced the concept of profile
  - ELF can be seen as a profile of INSPIRE

- 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)

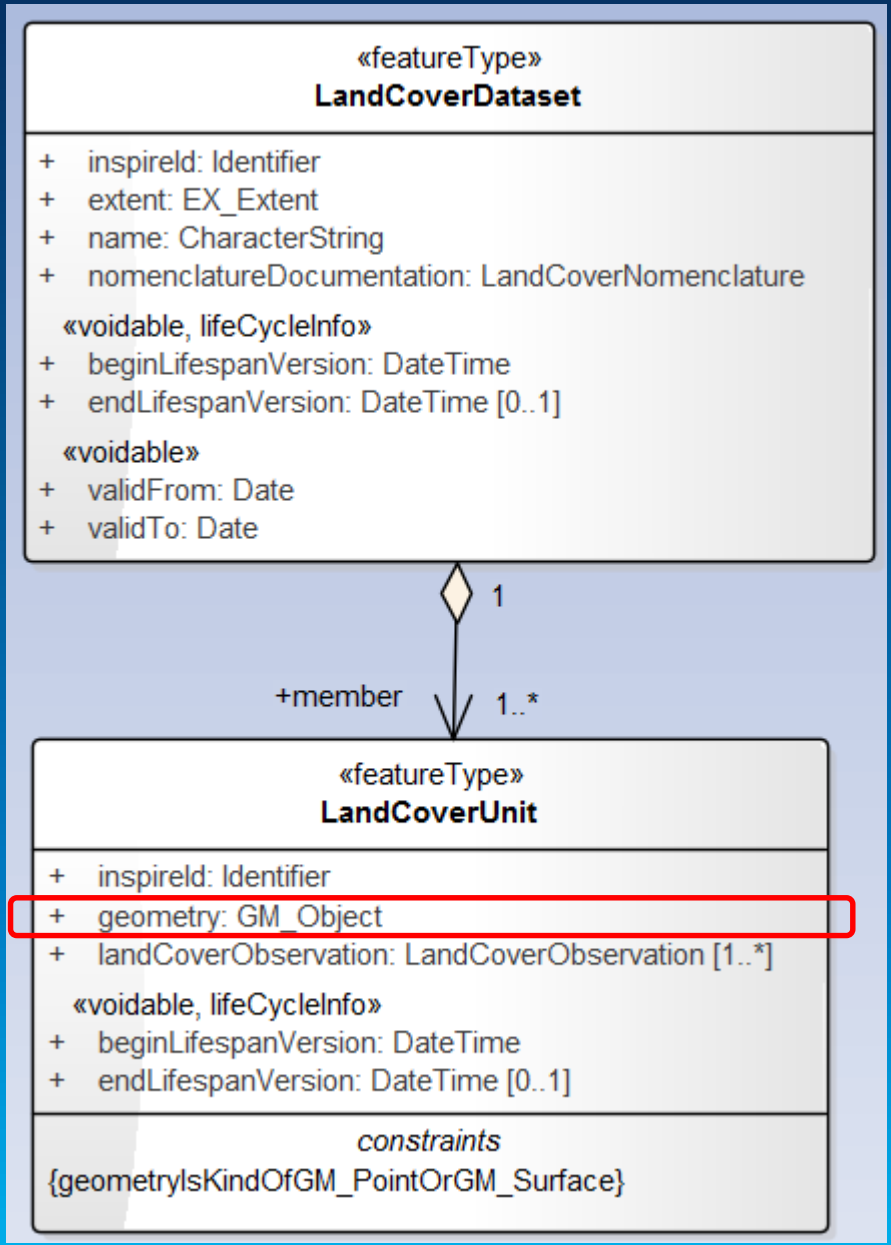
ISO INSPIRE UML model



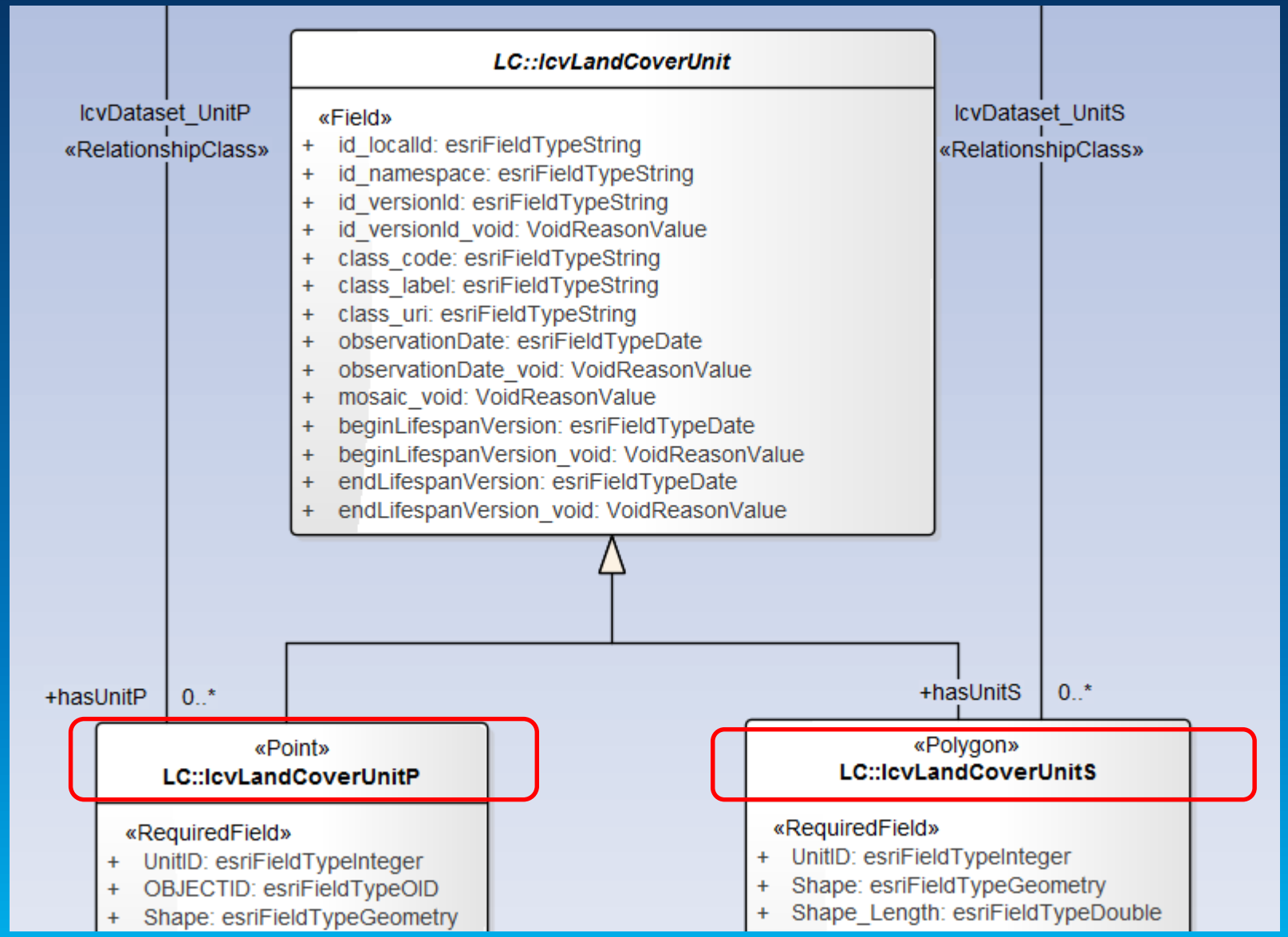
Esri Geodatabase Implementation in UML



ISO INSPIRE UML model



Esri Geodatabase Implementation in UML

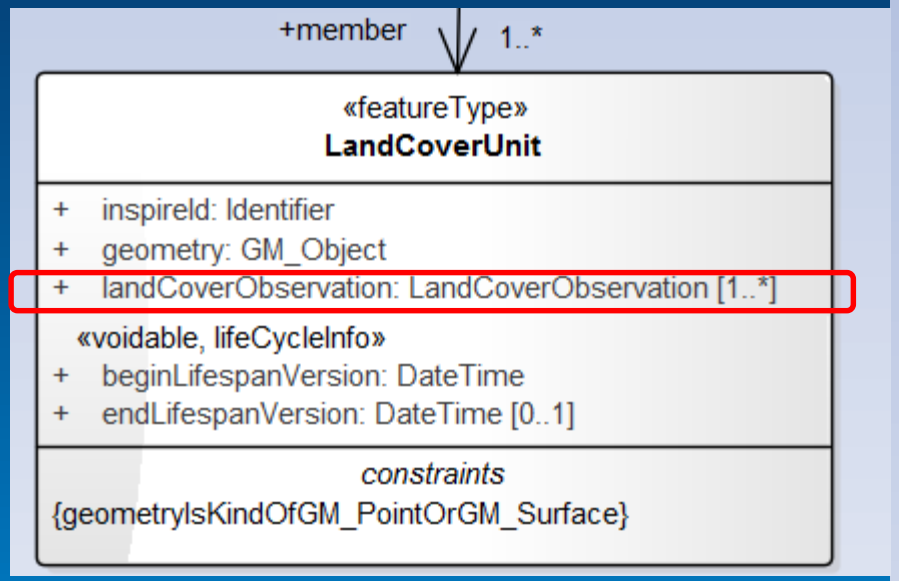


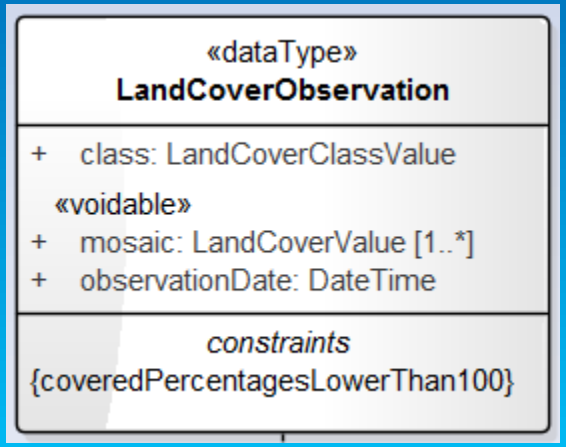
11.3 Styles recommended to be supported by INSPIRE view services

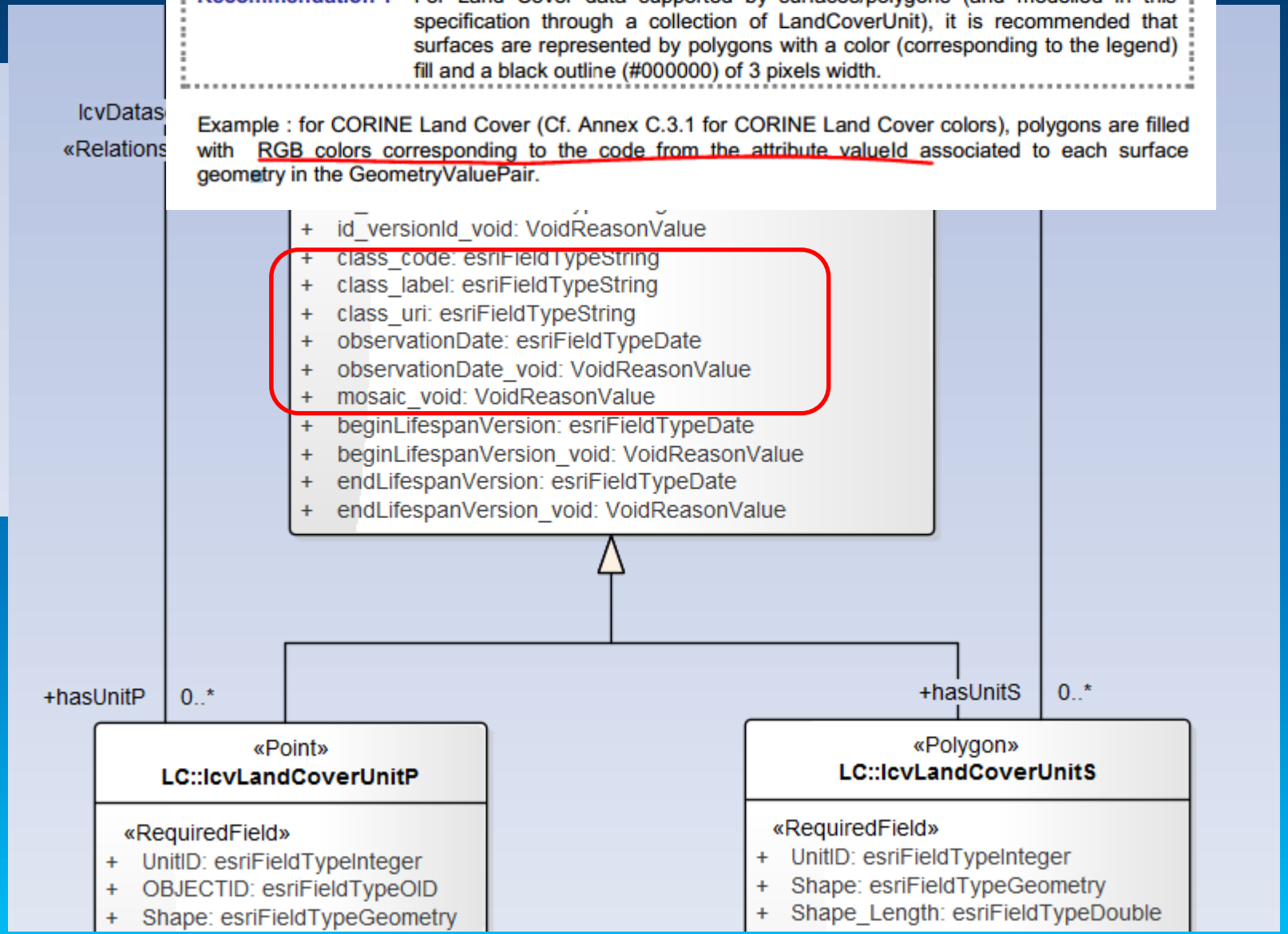
As this specification is generic and does not require the usage of a specific nomenclature, the previous default styles only represent the geometries supporting Land Cover information and not the information itself. It is however recommended that WMS servers implement styles that allow :

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.

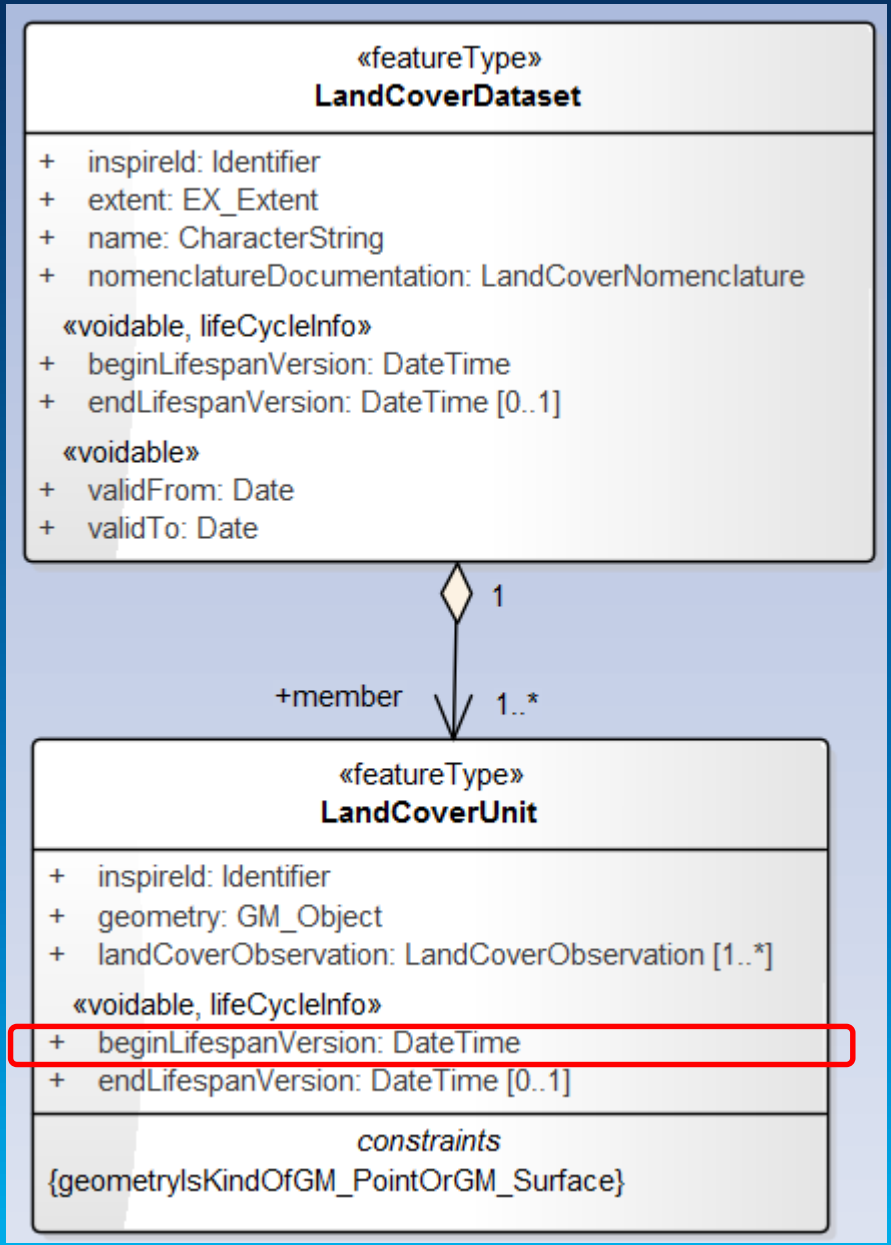
Example : for CORINE Land Cover (Cf. Annex C.3.1 for CORINE Land Cover colors), polygons are filled with RGB colors corresponding to the code from the attribute valueId associated to each surface geometry in the GeometryValuePair.



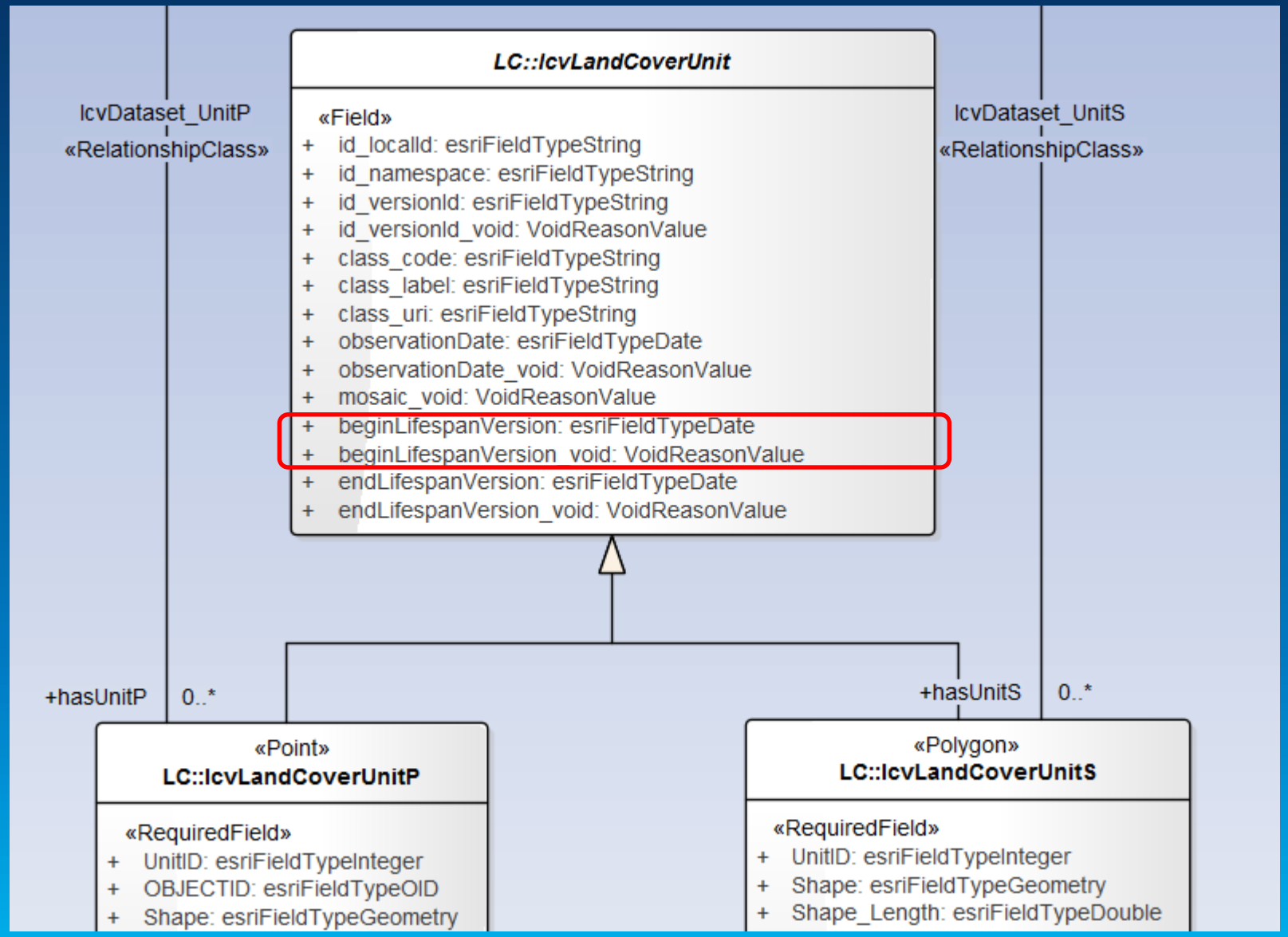




ISO INSPIRE UML model



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

Esri geodatabase in ArcGIS systems

Contents | Preview | Description

Name

- inspiregdb.sde.lcvDataset_UnitP
- inspiregdb.sde.lcvDataset_UnitS
- inspiregdb.sde.lcvLandCoverDataset
- inspiregdb.sde.lcvLandCoverUnitP
- inspiregdb.sde.lcvLandCoverUnitS

Feature Class Properties

General | Editor Tracking | XY Coordinate System | Domain, Resolution and Tolerance

Fields | Indexes | Subtypes | Feature Extent | Relationships | Representations

Field Name	Data Type
unitid	Long Integer
objectid	Object ID
id_localid	Text
id_namespace	Text
id_versionid	Text
id_versionid_void	Short Integer
class_code	Text
class_label	Text
class_uri	Text
observationdate	Date
observationdate_void	Short Integer
mosaic_void	Short Integer
beginlifespanversion	Date
endlifespanversion	Date

Click any field to see its properties.

Field Properties

Alias	unitid
Allow NULL values	Yes
Default Value	
Domain	
Precision	10

Import...

Beyond INSPIRE to ELF

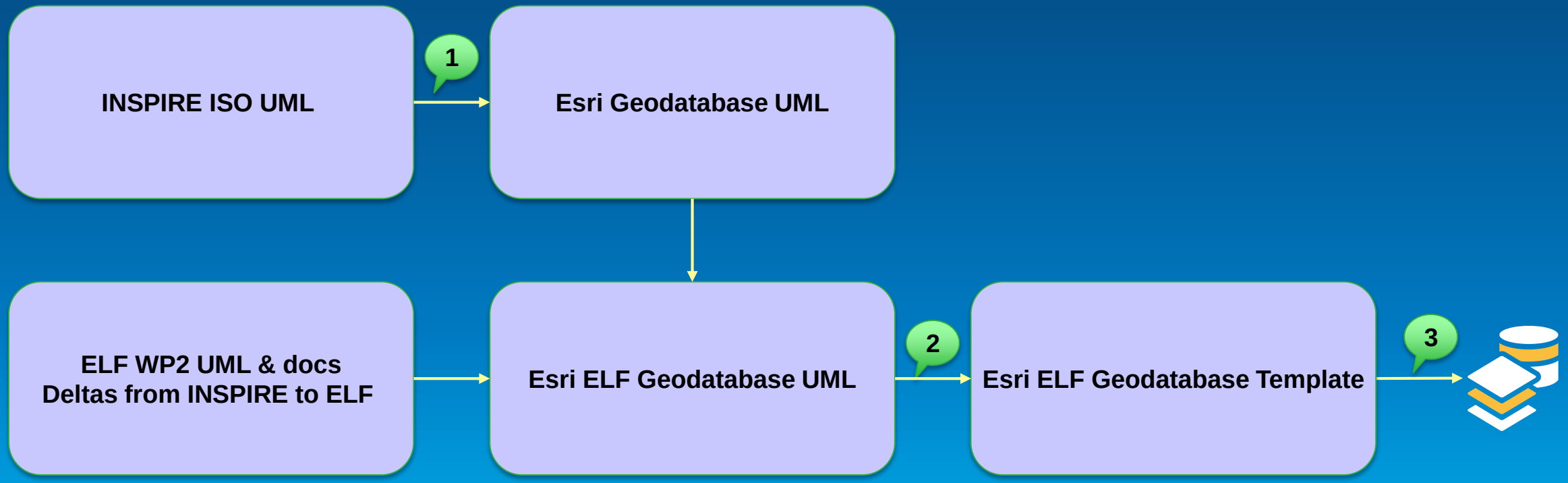
Extend ArcGIS INSPIRE templates for ELF

- Will take time, and need to learn and evolve best practice

1. Change existing INSPIRE geodatabase UML for Annex I to incorporate the new ELF pieces of information
2. Regenerate geodatabase templates from UML
3. Change the GML mapping so that the ELF additional elements can be exposed to view and download services
4. Deliver as beta version to interested mapping agencies, for evaluation within ELF project

Generating the physical Esri geodatabase Implementation

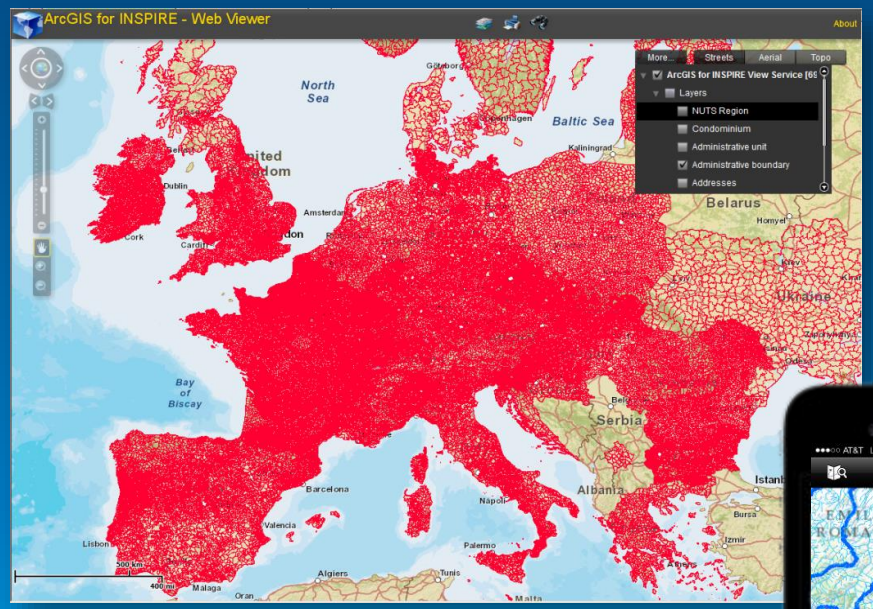
With ELF additions and changes

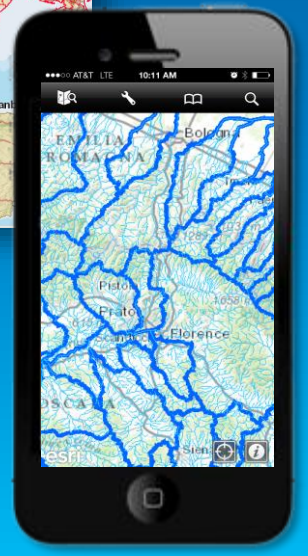


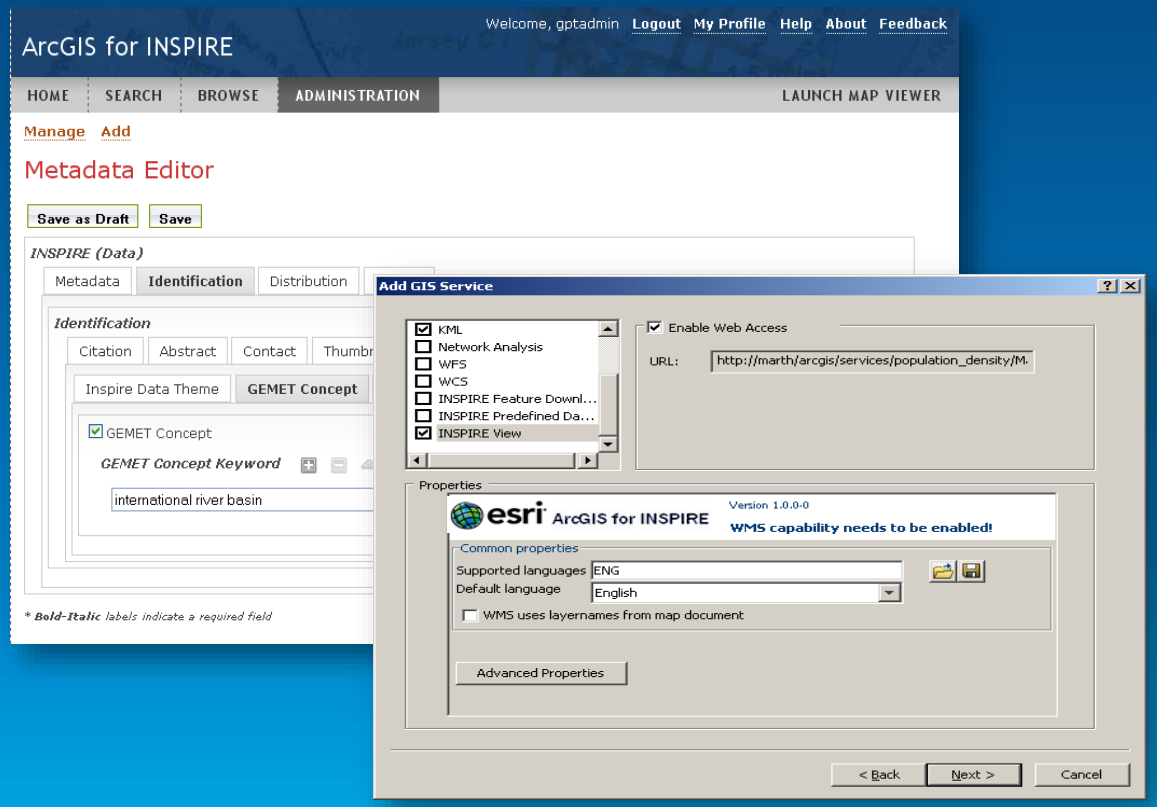
- **Applying just the changes from INSPIRE to ELF Schema to the GDB UML**

ArcGIS For INSPIRE

Enabling NMCAs to achieve INSPIRE and ELF goals







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