



# ECDIS Interoperability Catalogue

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Sep 13<sup>th</sup> , 2016

- Phase 1 - Interoperability Analysis
  - Draft - Mar/2016 and Final Report – May/2016
- Phase 2 – Interoperability Catalogue Design
  - Interoperability Design Document
  - UML models + XML schemas + extras
  - Jul/2016
- Phase 3 – Interoperability Catalogue Authoring
  - Draft Interoperability Catalogue (IC) XML
  - Sep/2016

- Long and diverse list of requirements ~70
- Provide support for complex data loading scenarios
  - Data Interleaving
  - Partial Data Suppression
  - Data Replacement
  - Partial Data Replacements
  - Data Overlays
- Facilitate easy loading of predefined product combinations

- Address Potential Data Clashes
  - Duplicate Feature Instances
  - Duplicate Feature Domains
  - Combined Geometry
  - Spatial Discrepancies
- Facilitate Skin-Of-The Earth Replacement
- Provide support for comprehensive hierarchy of data and display priorities

- Support Harmonized Portrayal
  - Display of Significant Features
  - Avoid Obscuring Overlay
  - Colour Set-Asides
  - Day / Night / Dusk Modes
  - Portrayal of Data Quality for Combinations of Information Layers
  - Display of Text

- Encryption and Authentication
- Management of FC and PC Updates
- Dataset Provisions
  - Dataset coverages and max/min display scales may need to be harmonized for consistent handling of dataset loading and unloading
  - Feature geometry should be harmonized.
  - Feature types and attributes may need to be harmonized.
- Joint Data Quality Measures

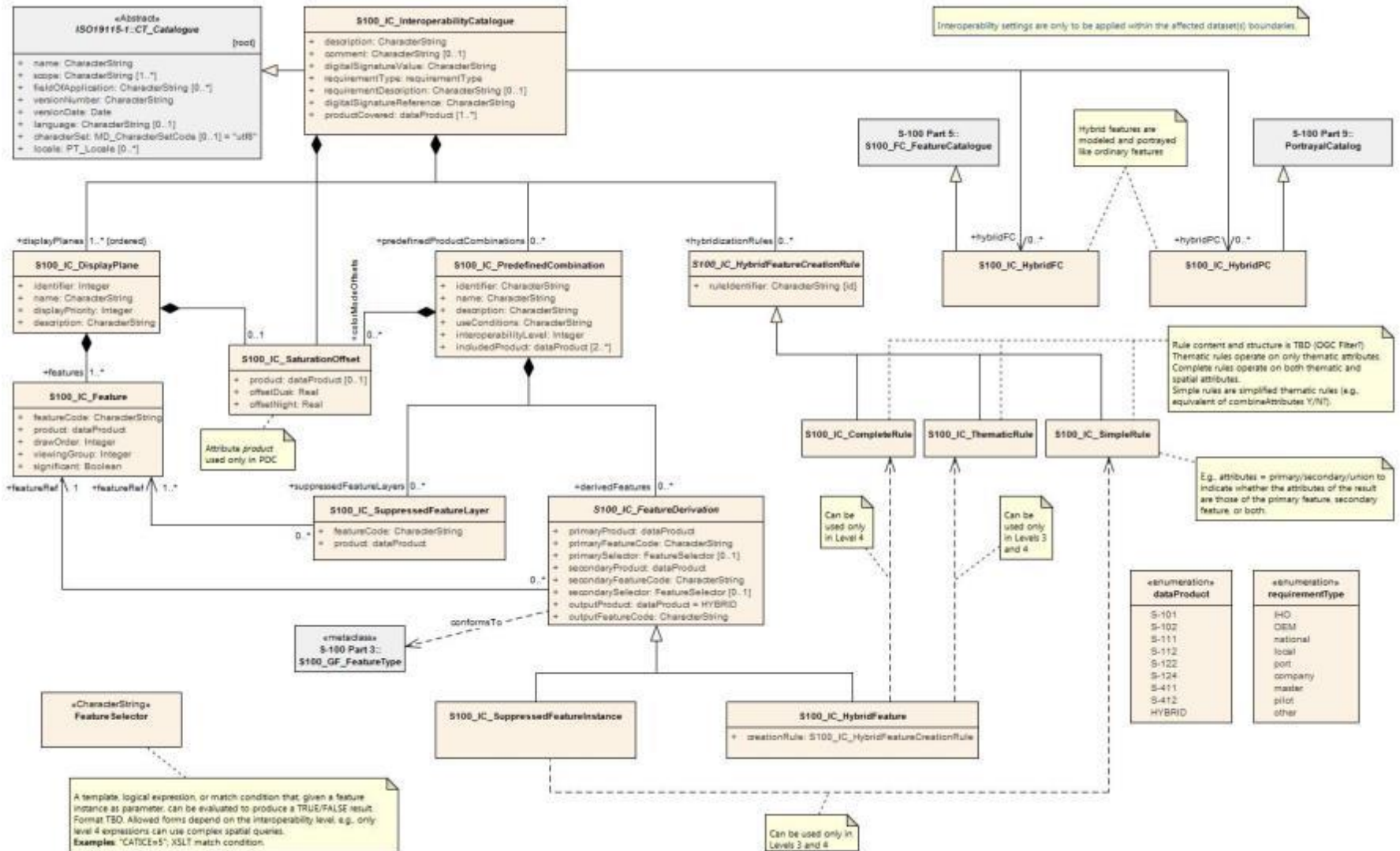
- Change of paradigm – ENC is now part of larger data ecosystem
- Modular, machine readable design leveraging existing designs for FC, PC, and geospatial rules
- Fully user-controlled via system settings
- Compatible with existing portrayal engine
- Supporting different levels of interoperation
- Additional customization by OEMs or users possible

- Level 0 – No explicit interoperability and IC is not used; ENC is the main product; all other data is loaded as overlays – effectively current ECDIS
- Level 1 – Data interleaving; ENC is the main product but feature layers from other products are interleaved with ENC feature layers
- Level 2 - Type-based selective feature class replacement; ENC is the main product but global suppression of equivalent ENC features is allowed in favor of data layers from superior data products

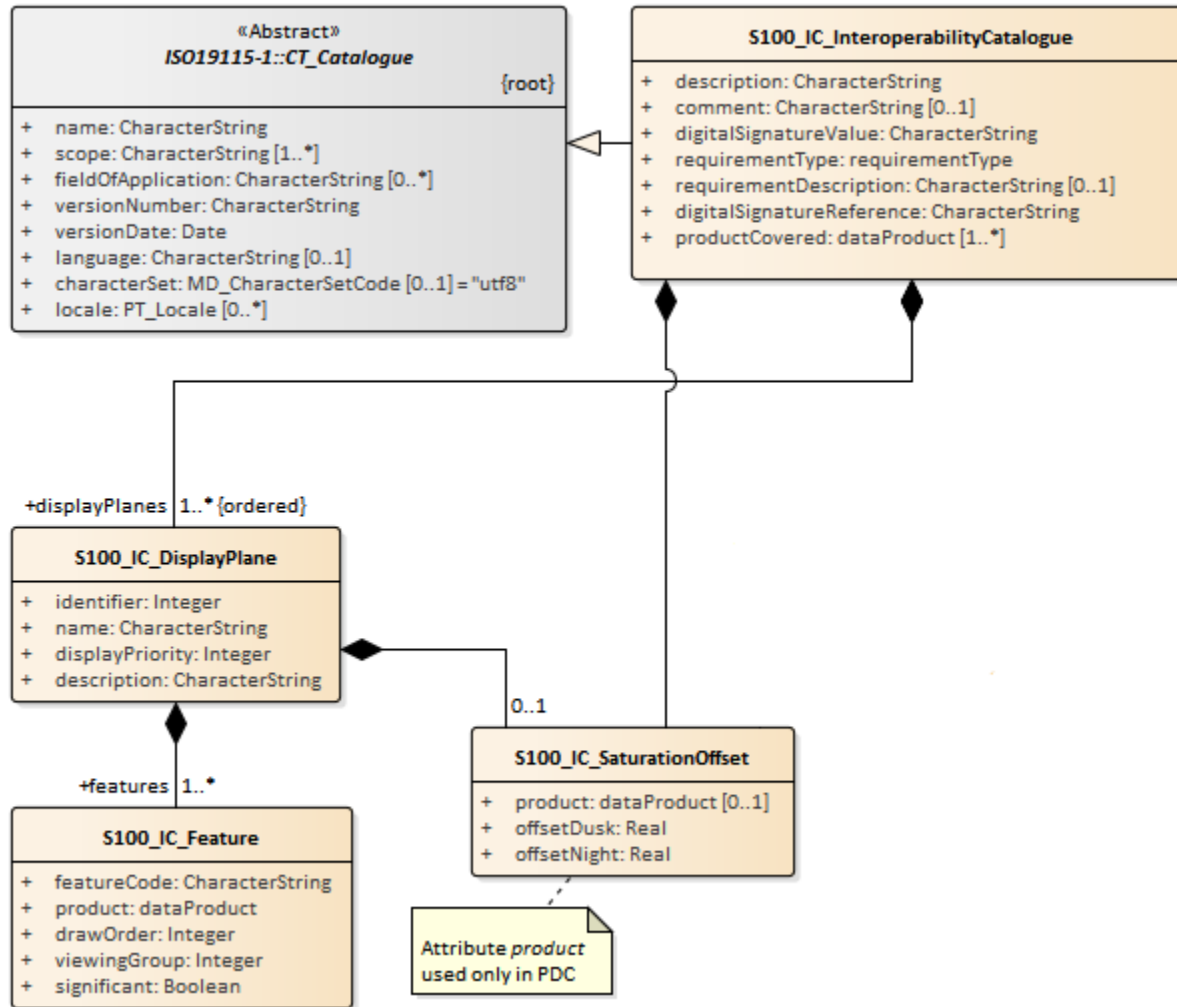


- Level 3 - Attribute value-based selectivity and feature hybridization; ENC is treated as one of the components of the data stack, and selected feature instances from other products may be treated as being superior to or enhancing selected ENC feature instances
- Level 4 - Spatial operations; This level is the same as Level 3, but permits spatial queries (to determine related subsets) and operations (to define the interoperation result) to determine replacements for selected feature instances; rules are explicitly defined using an adequate set of spatially-capable 'grammar'

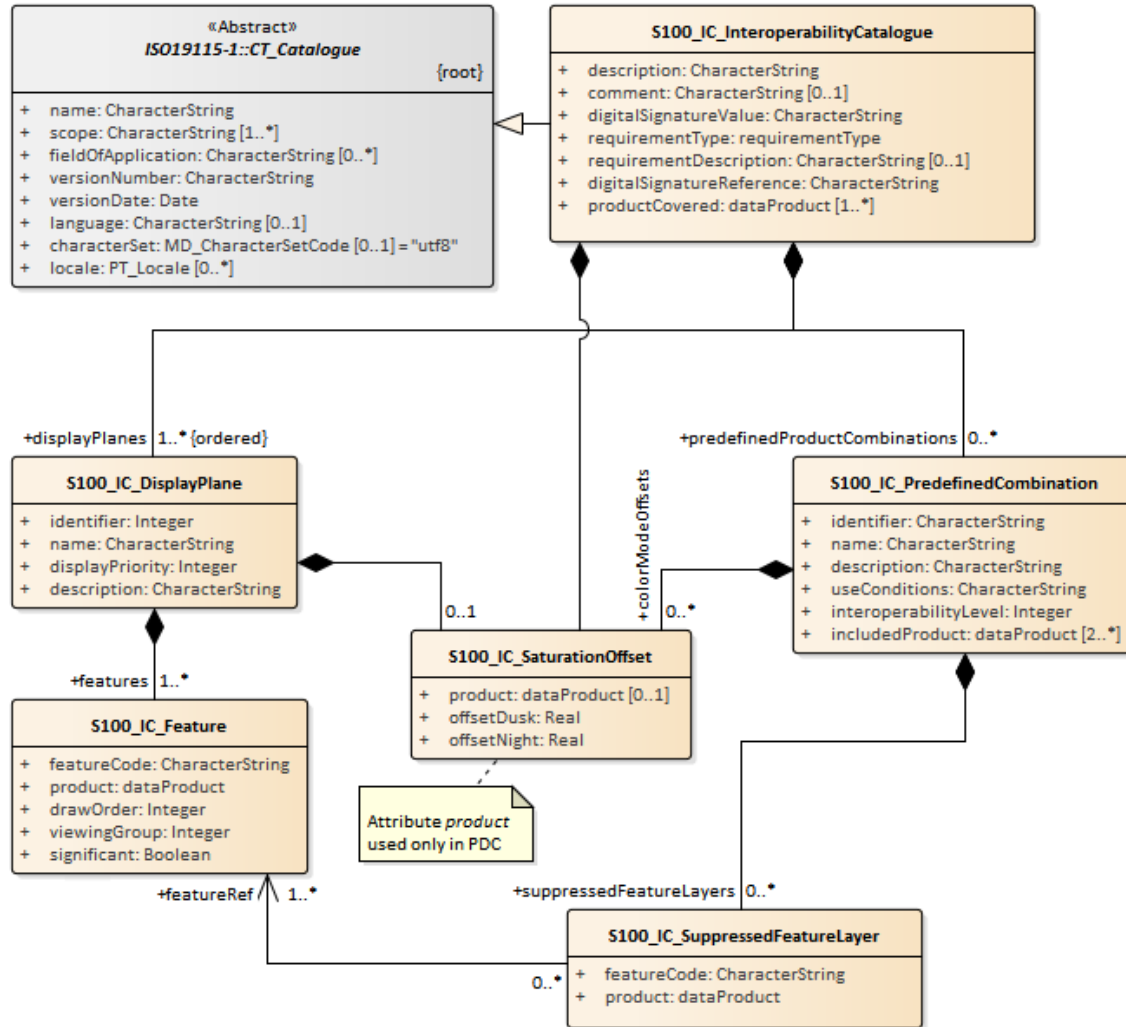
# Interoperability Catalogue Model



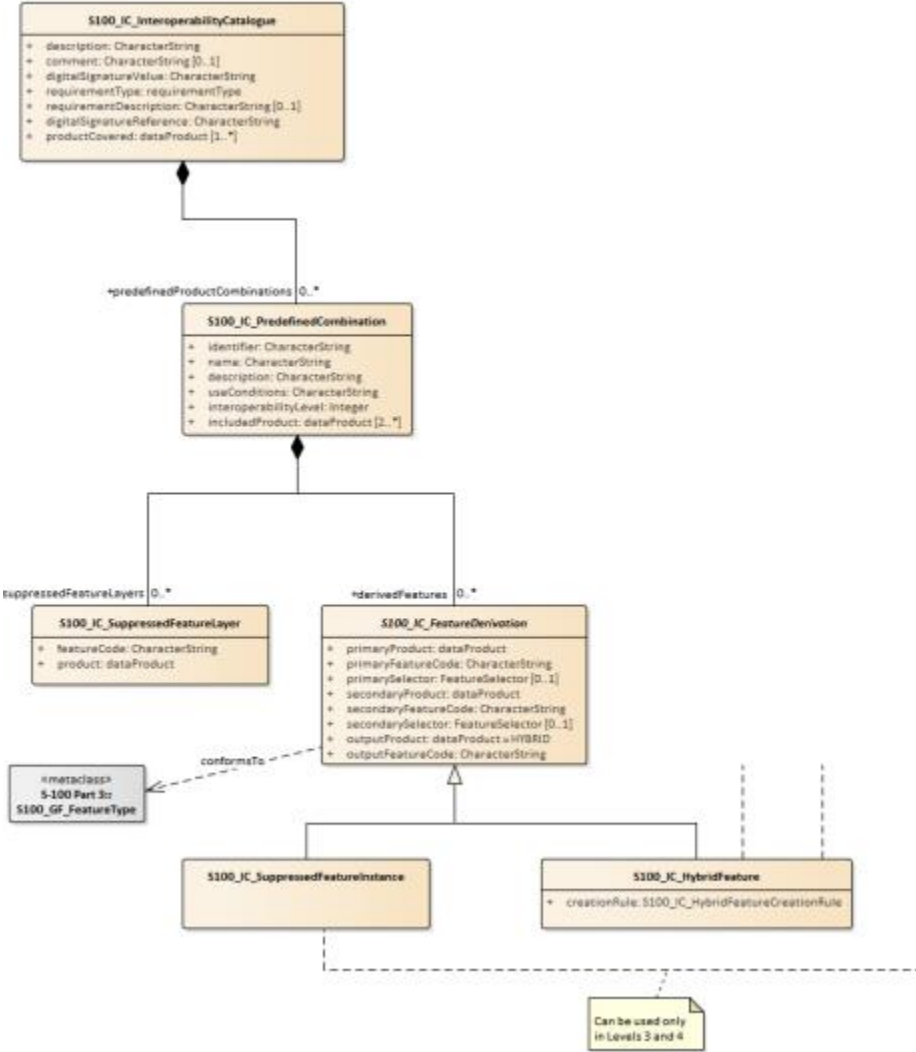
# Interoperability Catalogue Level 1



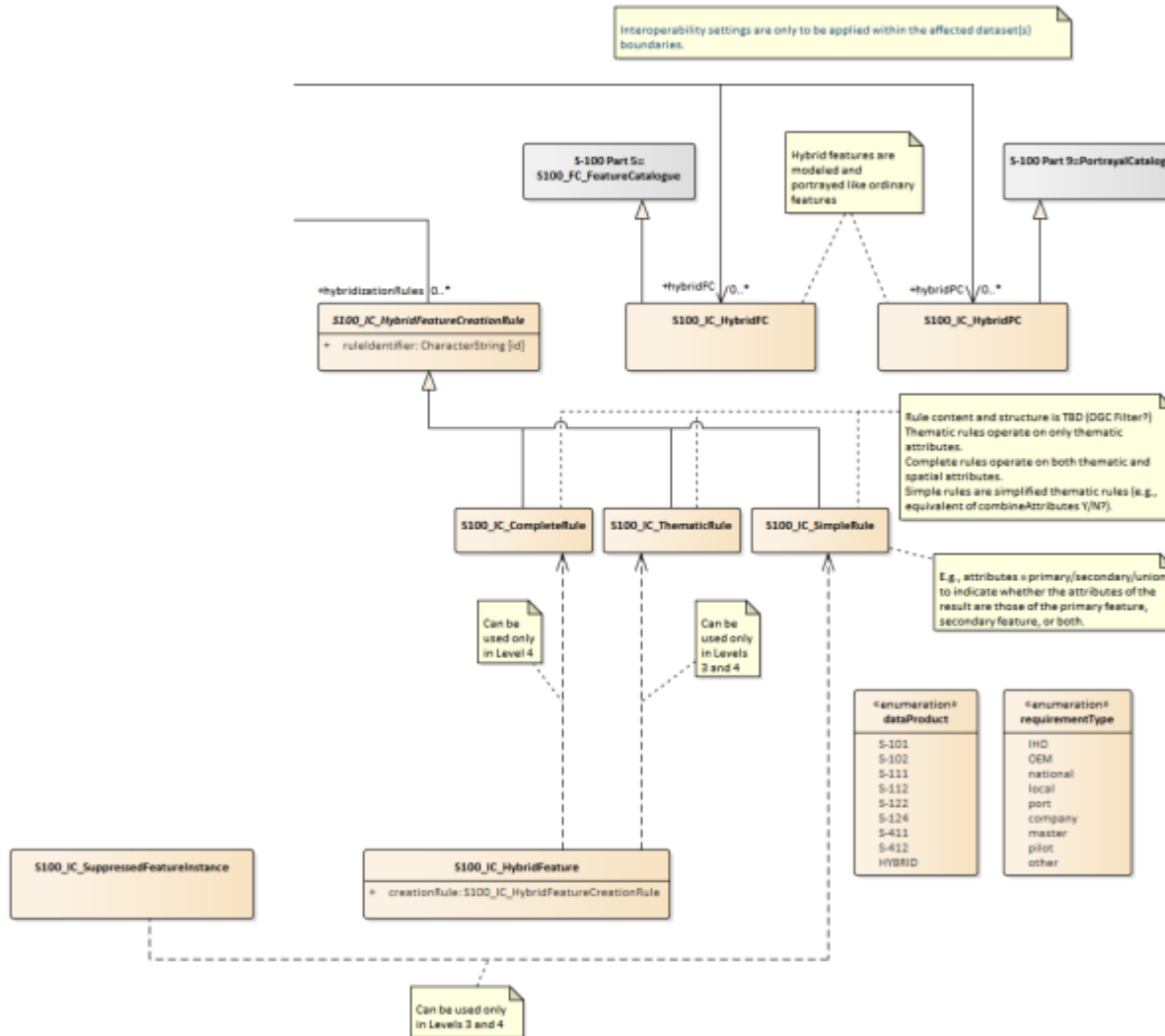
# Interoperability Catalogue Level 2



# Interoperability Catalogue Level 3 and 4



# Interoperability Catalogue Level 3 and 4



# Interoperability Catalogue XML

```
<S100IC:S100_IC_InteroperabilityCatalogue xmlns:S100IC="http://www.iho.int/S100/IC"
xmlns:gmd="http://www.isotc211.org/2005/gmd"
xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.iho.int/S100/IC S100_IC.xsd">
  <name>IOPC201600001</name>
  <scope>interoperability</scope>
  <versionNumber>1</versionNumber>
  <versionDate>2016-07-11</versionDate>
  <language>eng</language>
  <description>Example of interoperation catalogue</description>
  <comment>This is a hypothetical example</comment>
  <digitalSignatureReference>none</digitalSignatureReference>
  <digitalSignatureValue></digitalSignatureValue>
  <requirementType>IHO</requirementType>
  <productCovered>S-101</productCovered>
  <productCovered>S-102</productCovered>
  <productCovered>S-111</productCovered>
  <productCovered>S-112</productCovered>
  <productCovered>S-122</productCovered>
  <productCovered>S-124</productCovered>
  <productCovered>S-411</productCovered>
  <productCovered>S-412</productCovered>
  <S100_IC_SaturationOffset>
    <offsetDusk>0.5</offsetDusk>
    <offsetNight>0.3</offsetNight>
  </S100_IC_SaturationOffset>
</S100_IC_InteroperabilityCatalogue>
```

# Interoperability Catalogue XML

```
<S100_IC_DisplayPlane>
  <identifier>2</identifier>
  <name>baseBathy</name>
  <displayPriority>2</displayPriority>
  <description>all S-101 bathy features are located here</description>
  <S100_IC_SaturationOffset>
    <offsetDusk>0.5</offsetDusk>
    <offsetNight>0.3</offsetNight>
  </S100_IC_SaturationOffset>
  <features>
    <S100_IC_Feature id="urn:mrn:iho:s101:1.0:DEPARE">
      <featureCode>DepthArea</featureCode>
      <product>S-101</product>
      <drawOrder>1</drawOrder>
      <viewingGroup>20280</viewingGroup>
      <significant>>false</significant>
    </S100_IC_Feature>
    <S100_IC_Feature id="urn:mrn:iho:s101:1.0:DEPCNT">
      <featureCode>DepthContour</featureCode>
      <product>S-101</product>
      <drawOrder>2</drawOrder>
      <viewingGroup>20280</viewingGroup>
      <significant>>false</significant>
    </S100_IC_Feature>
  </features>
</S100_IC_DisplayPlane>
<S100_IC_DisplayPlane>
  <identifier>3</identifier>
  <name>overBaseBathy</name>
  <displayPriority>3</displayPriority>
  <description>all S-102 bathy features are located here</description>
```



```
<predefinedProductCombinations>
  <S100_IC_PredefinedCombination>
    <identifier>urn:mrn:iho:iop:0.1:pd:1</identifier>
    <name>ENCandCurrents</name>
    <description>combined S-101 and S-111 - suppressing all ENC current info</description>
    <useConditions>all conditions</useConditions>
    <interoperabilityLevel>2</interoperabilityLevel>
    <includedProduct>S-101</includedProduct>
    <includedProduct>S-111</includedProduct>
    <suppressedFeatureLayers>
      <S100_IC_SuppressedFeatureLayer id="urn:mrn:iho:iop:0.1:sfl:1">
        <featureCode>CurrentNonGravitational</featureCode>
        <product>S-101</product>
        <featureRef>urn:mrn:iho:s101:1.0:CURRENT</featureRef>
      </S100_IC_SuppressedFeatureLayer>
    </suppressedFeatureLayers>
    <colorModeOffsets>
      <S100_IC_SaturationOffset>
        <product>S-101</product>
        <offsetDusk>0.5</offsetDusk>
        <offsetNight>0.7</offsetNight>
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```

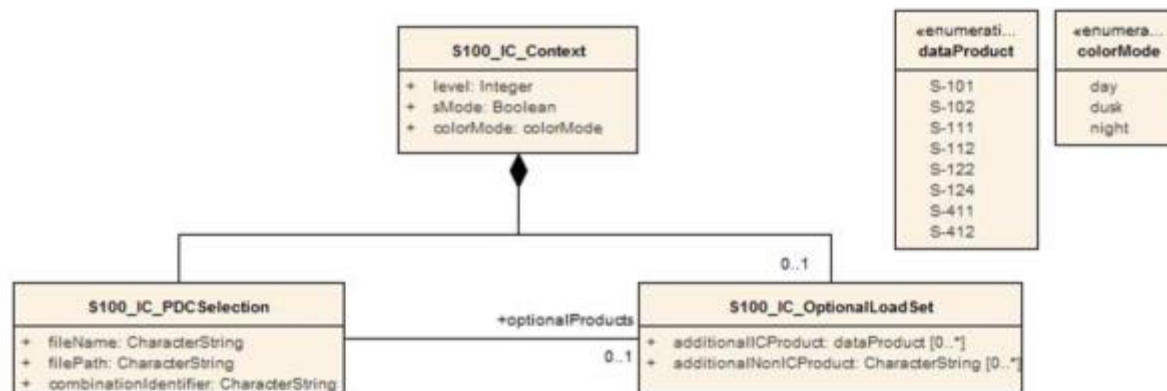
# Interoperability Catalogue XML

```
<S100_IC_PredefinedCombination>
  <identifier>urn:mrn:iho:iop:0.1:pd:2</identifier>
  <name>ENCandICE</name>
  <description>combined S-101 and S-411 - suppressing individual ENC ice objects based on their CATICE value</description>
  <useConditions>all conditions</useConditions>
  <interoperabilityLevel>4</interoperabilityLevel>
  <includedProduct>S-101</includedProduct>
  <includedProduct>S-411</includedProduct>
  <derivedFeatures>
    <S100_IC_SuppressedFeatureInstance id="urn:mrn:iho:iop:0.1:sfi:1">
      <primaryProduct>S-101</primaryProduct>
      <primaryFeatureCode>IceArea</primaryFeatureCode>
      <primarySelector>categoryOfIce=5</primarySelector>
      <secondaryProduct>S-411</secondaryProduct>
      <secondaryFeatureCode>IcebergArea</secondaryFeatureCode>
      <outputProduct>HYBRID</outputProduct>
      <outputFeatureCode>IcebergAreaHybrid</outputFeatureCode>
      <featureRef>urn:mrn:iho:iop:0.1:IcebergAreaHybrid</featureRef>
    </S100_IC_SuppressedFeatureInstance>
    <S100_IC_HybridFeature id="urn:mrn:iho:iop:0.1:hyf:1">
      <primaryProduct>S-101</primaryProduct>
      <primaryFeatureCode>IceArea</primaryFeatureCode>
      <primarySelector>categoryOfIce=5</primarySelector>
      <secondaryProduct>S-411</secondaryProduct>
      <secondaryFeatureCode>IcebergArea</secondaryFeatureCode>
      <outputProduct>HYBRID</outputProduct>
      <outputFeatureCode>IcebergAreaHybrid</outputFeatureCode>
      <featureRef>urn:mrn:iho:iop:0.1:IcebergAreaHybrid</featureRef>
      <creationRule>primaryAreaInsideSecondaryArea</creationRule>
    </S100_IC_HybridFeature>
  </derivedFeatures>
</S100_IC_PredefinedCombination>
```

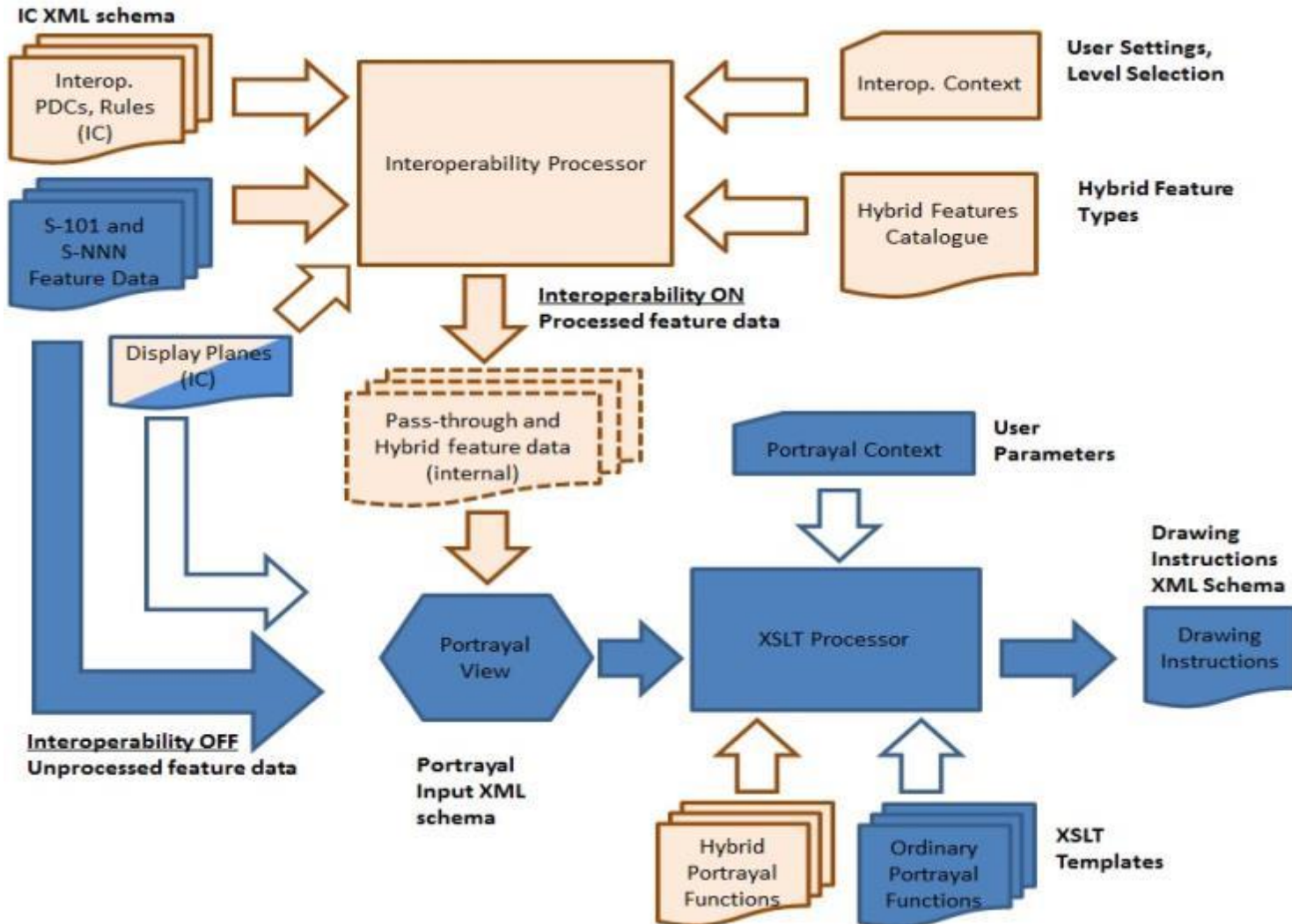
```
<hybridizationRules>
  <S100_IC_SimpleRule id="urn:mrn:iho:iop:1.0:rules:1.1">
    <ruleIdentifier>simpleRuleX</ruleIdentifier>
  </S100_IC_SimpleRule>
  <S100_IC_ThematicRule id="urn:mrn:iho:iop:1.0:rules:2.1">
    <ruleIdentifier>thematicRuleA</ruleIdentifier>
  </S100_IC_ThematicRule>
  <S100_IC_CompleteRule id="urn:mrn:iho:iop:1.0:rules:3.1">
    <ruleIdentifier>createDepthCoverageSafetyContour</ruleIdentifier>
  </S100_IC_CompleteRule>
  <S100_IC_CompleteRule id="urn:mrn:iho:iop:1.0:rules:3.2">
    <ruleIdentifier>primaryAreaInsideSecondaryArea</ruleIdentifier>
  </S100_IC_CompleteRule>
</hybridizationRules>

<hybridPC><S100_IC_HybridPC>HYBRIDPC.XML</S100_IC_HybridPC></hybridPC>
<hybridFC><S100_IC_HybridFC>HYBRIDFC.XML</S100_IC_HybridFC></hybridFC>
```

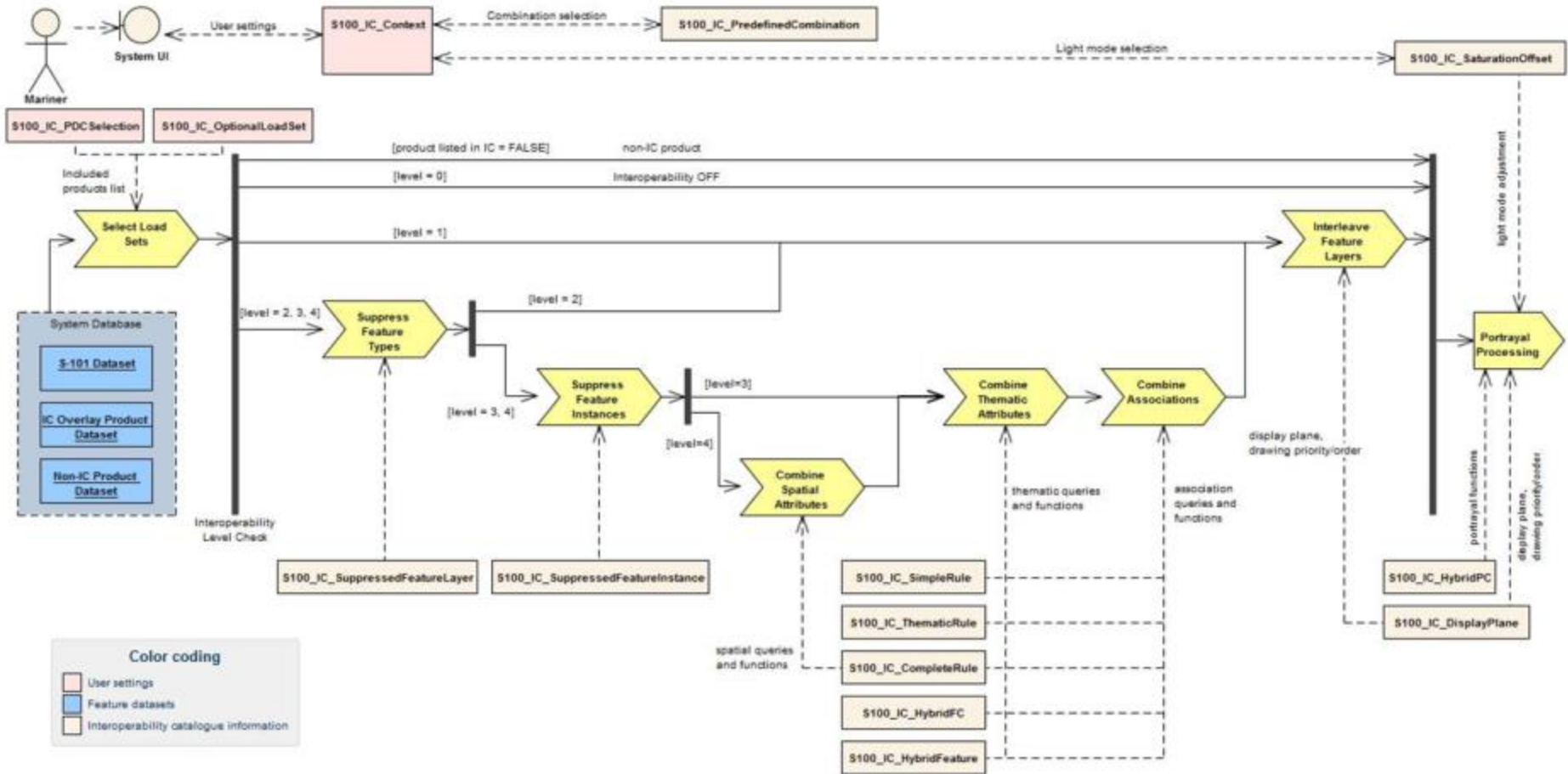
- Interoperability level selected by the mariner
- The predefined combination selected for loading by the mariner and any additional products to be loaded
- S-mode toggle setting
- Color mode – whether day, night or dusk palette must be used



# Interoperability Catalogue Integration



# Interoperability Catalogue Processing



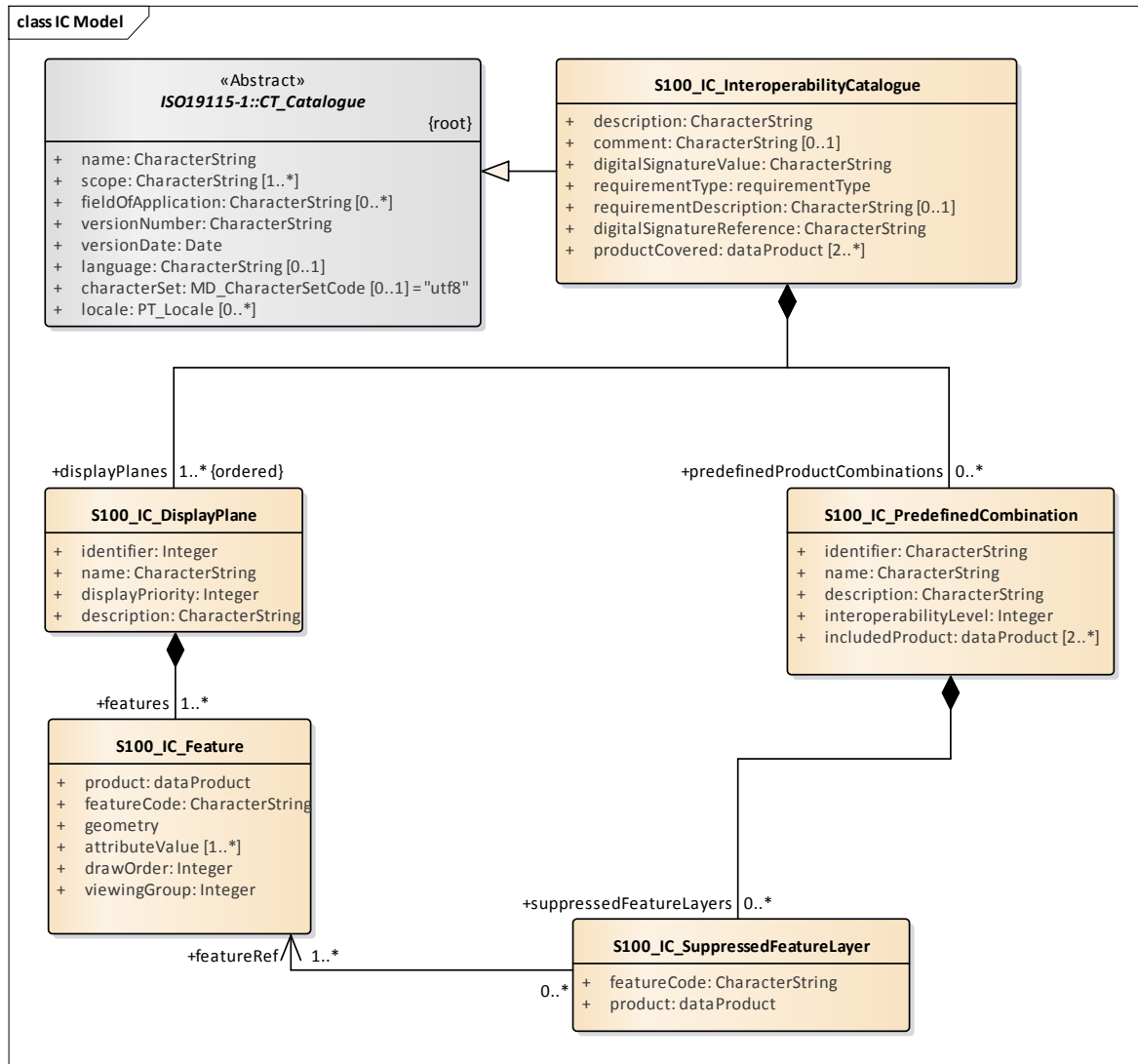
- Current IC draft covers Level 1 and is based on S-52
  - Display plane for each S-52 priority under radar
  - Display plane for radar data
  - Display plane for each S-52 priority over radar
  - Display plane for metadata
  - No attribute combination handling as this is done by PC
  - No effective viewing group handling (highest used) as some feature types have multiple viewing groups – viewing group handling should likely be moved to PC
  - Geometric primitive handling added to Level 1

- Few issues encountered
  - Features with multiple priorities in S-52 (highest used)
  - Features with multiple viewing groups
  - Feature in under and over radar
  - Features missing the alias FC 0.8.10
- Need sensible division between PC and IC
- Do we stay with some design principals from S-52 or do we move to something new?
- Handling metadata, currently done as separate display plane drawn on top of everything

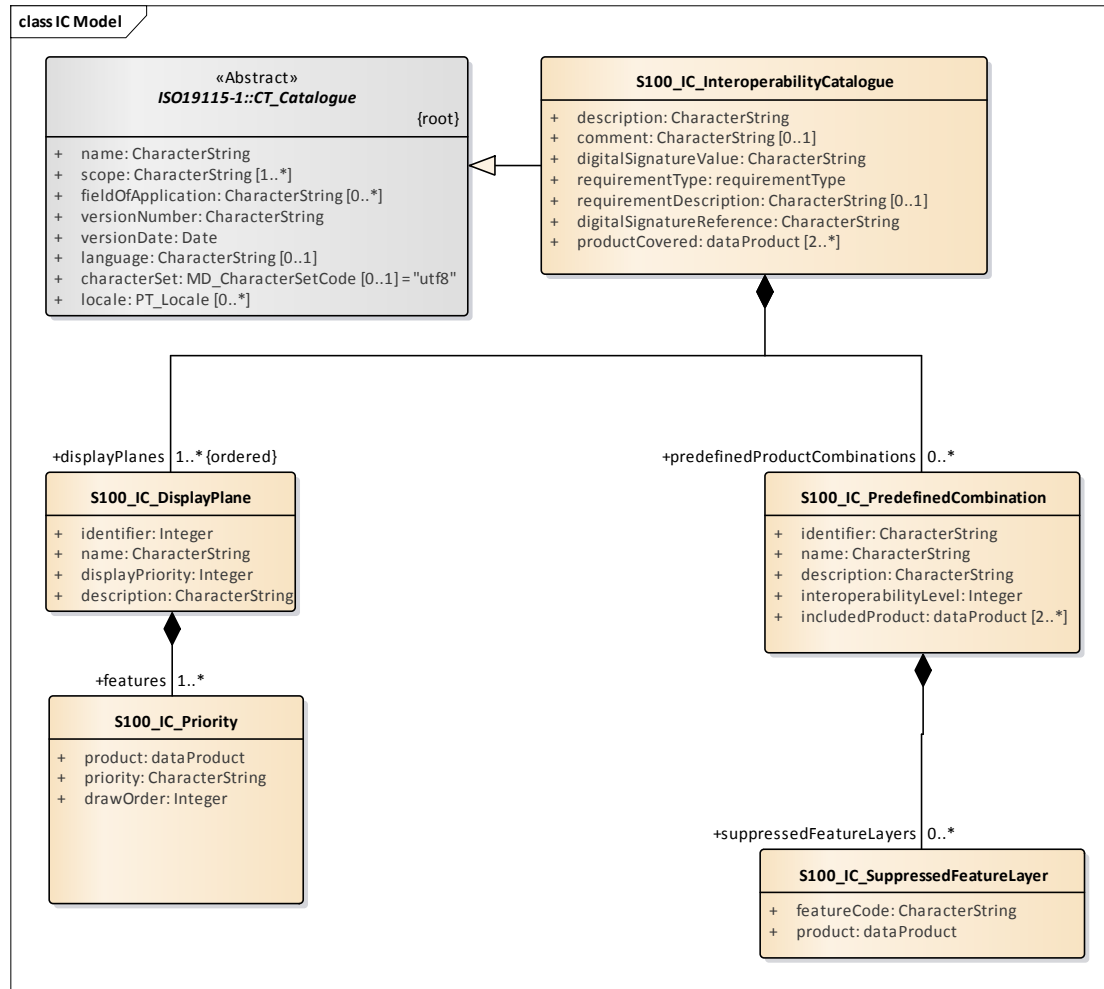


- Feedback from technical experts group
- Testing of Level 0/1/2 in practice
- Integration of refinements
- IC Product Specification V1.0 development and approval
- Level 2 and 3 refinements and testing
- IC Product Specification V2.0 development and approval

# Interoperability Catalogue Level 1 and 2



# Interoperability Catalogue Level 1 and 2



- Product.Feature.Geometry.Attribute = Product.DisplayPriority

```
<S100_IC_DisplayPlane>
  <identifier>2</identifier>
  <name>baseBathy</name>
  <displayPriority>2</displayPriority>
  <description>all S-101 bathy features are located here</description>
  <features>
    <S100_IC_Feature id="urn:mrn:iho:s101:1.0:DEPARE">
      <featureCode>DepthArea</featureCode>
      <featureGeometry>Area</featureGeometry>
      <attributeValue>...</attributeValue>
      <product>S-101</product>
      <drawOrder>1</drawOrder>
      <viewingGroup>20280</viewingGroup>
    </S100_IC_Feature>
    <S100_IC_Feature id="urn:mrn:iho:s101:1.0:DEPCNT">
      <featureCode>DepthContour</featureCode>
      <featureGeometry>Area</featureGeometry>
      <attributeValue>...</attributeValue>
      <product>S-101</product>
      <drawOrder>2</drawOrder>
      <viewingGroup>20280</viewingGroup>
    </S100_IC_Feature>
  </features>
</S100_IC_DisplayPlane>
```

- Product.Feature.Geometry.Attribute = Product.DisplayPriority

```
<S100_IC_DisplayPlane>
  <identifier>2</identifier>
  <name>baseBathy</name>
  <displayPriority>2</displayPriority>
  <description>all S-101 bathy features are located here</description>
  <features>
    <S100_IC_Prioirity>
      <priority>1</prioirity>
      <product>S-101</product>
      <drawOrder>1</drawOrder>
    </S100_IC_Feature>
    <S100_IC_Prioirity>
      <priority>1</prioirity>
      <product>S-102</product>
      <drawOrder>2</drawOrder>
    </S100_IC_Feature>
  </features>
</S100_IC_DisplayPlane>
```

**Questions?**