International Coastal Web Atlas (ICWA) prototype Version 3

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IODE International Oceanographic Data and Information Exchange

Outline

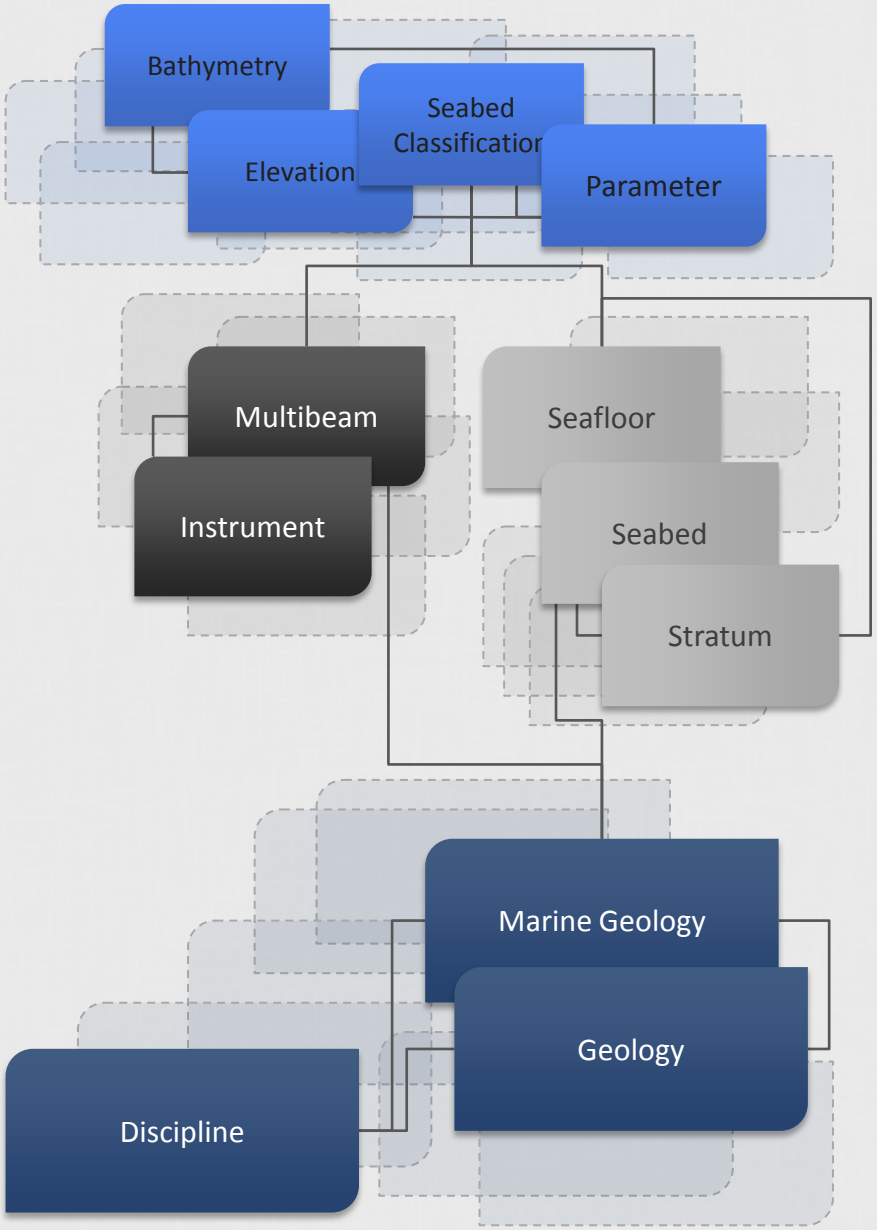
- Terminology
- Problem
- Approach
- Improvements
- Demonstration
- Connecting Atlases
- Current Work

Interoperability

Make distributed heterogeneous information systems (web services, databases, etc.) communicate

Semantics

Meaning of “information” (data, metadata, etc.): term definitions, semantic relationships, etc.

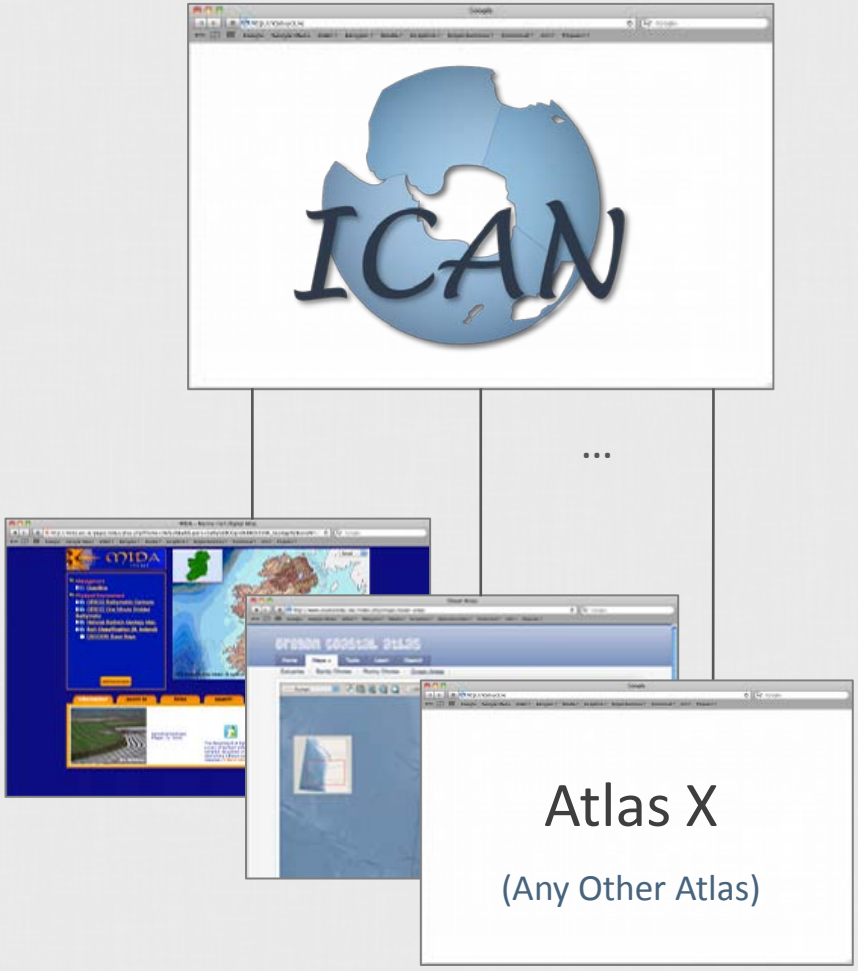


Coastal Web Atlas (CWA)

Web application for the delivery of coastal resources, including: maps, geospatial data, metadata, thematic information

CWA Semantic Interoperability

Providing seamless access to distributed, and semantically heterogeneous coastal web atlases



Problem

- Heterogeneity:
  - Syntactic (data formats, query languages)
  - Structural (data schemas)
  - Semantic (meaning of data values)

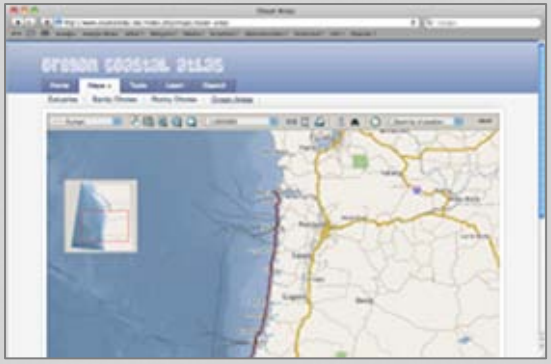
Example: Metadata

- Different metadata standards (ISO-19115 vs. FGDC)
- Different vocabularies: 'Seabed' vs. 'Seafloor'
  'Coastline' vs. 'Shoreline'
  French, Spanish, English…

Problem

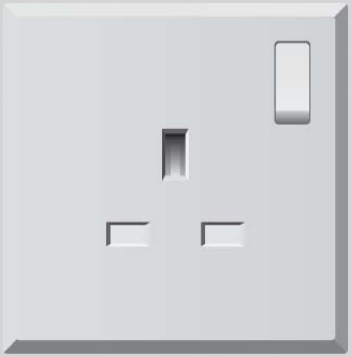
“Coastline”

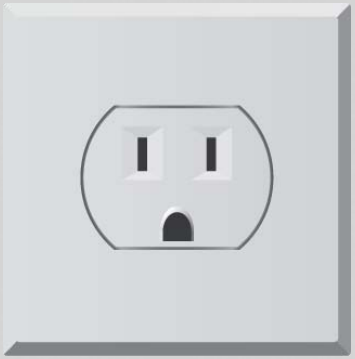
“Shoreline”



“Ligne de côte”

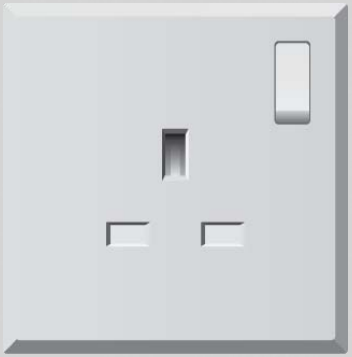
Problem

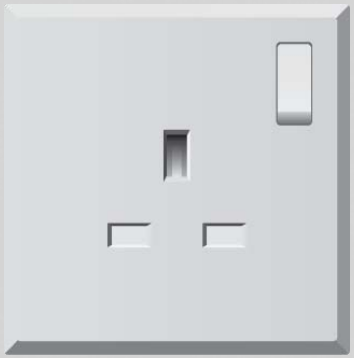


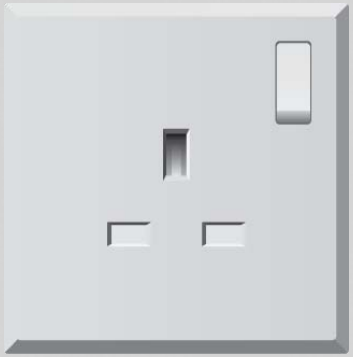


Approaches

Approach 1: Standardisation

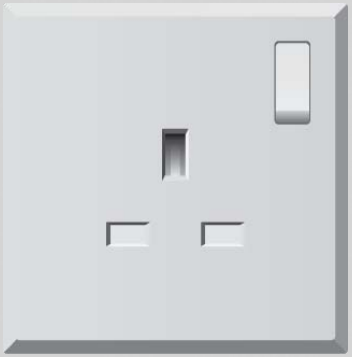


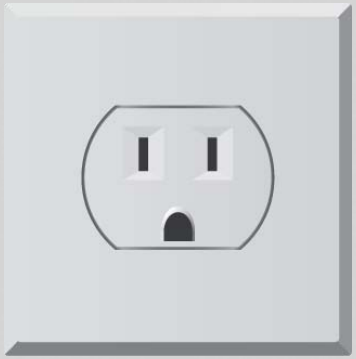




Approaches

Approach 2: Mediation (Adaptor)





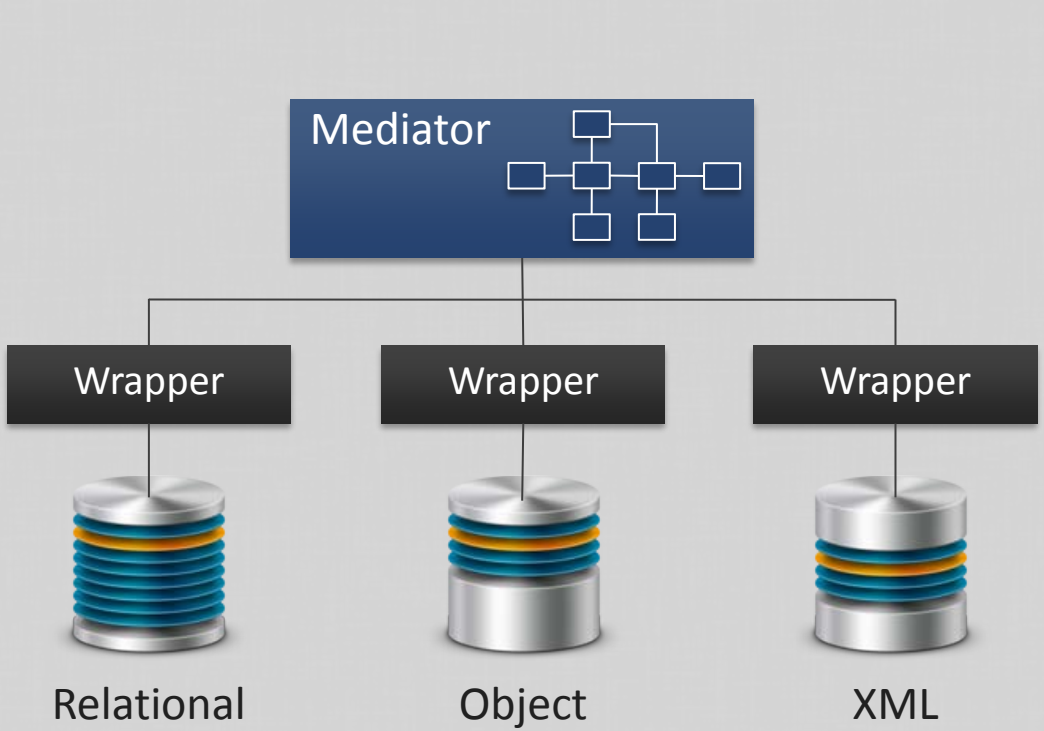
Standardisation

- Standardise access interfaces and data formats
  - Implement OGC Web Services
  - Use metadata standards
    - ISO-19115, ISO-19139, ISO-19119, Dublin Core

Standardisation

- Open Geospatial Consortium (OGC) Web Services
  - OGC specification
  - Interface allowing requests for geographic "*resources*" across the Web using platform-independent calls
  - Common OGC services:
    - Catalogue Service for the Web (CSW)
    - Web Feature Service (WFS)
    - Web Coverage Service (WCS)
    - Web Map Service (WMS)

Mediation

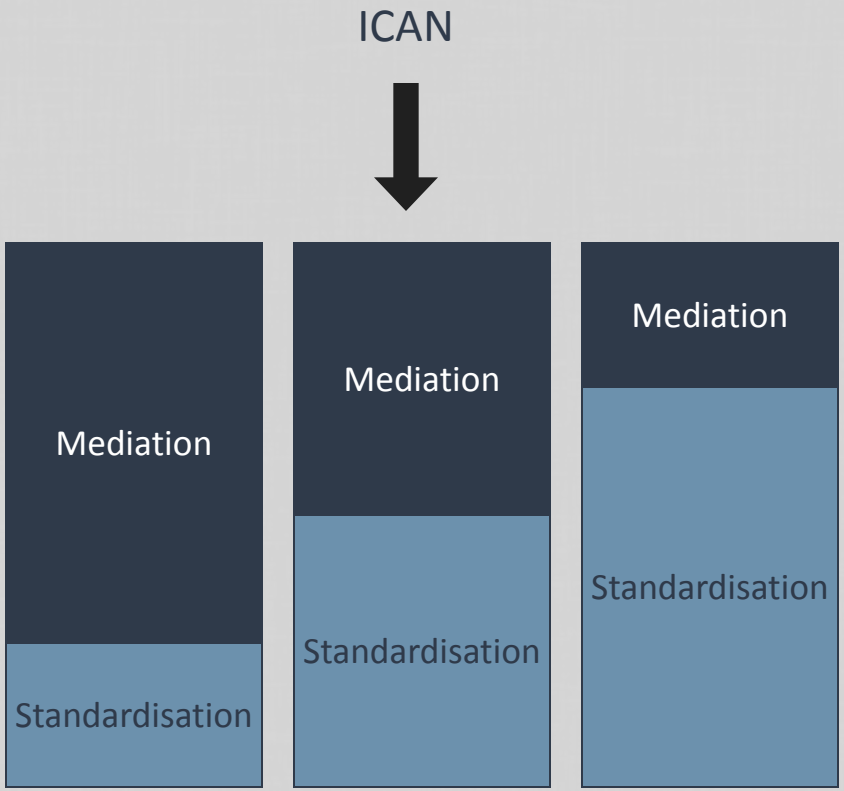


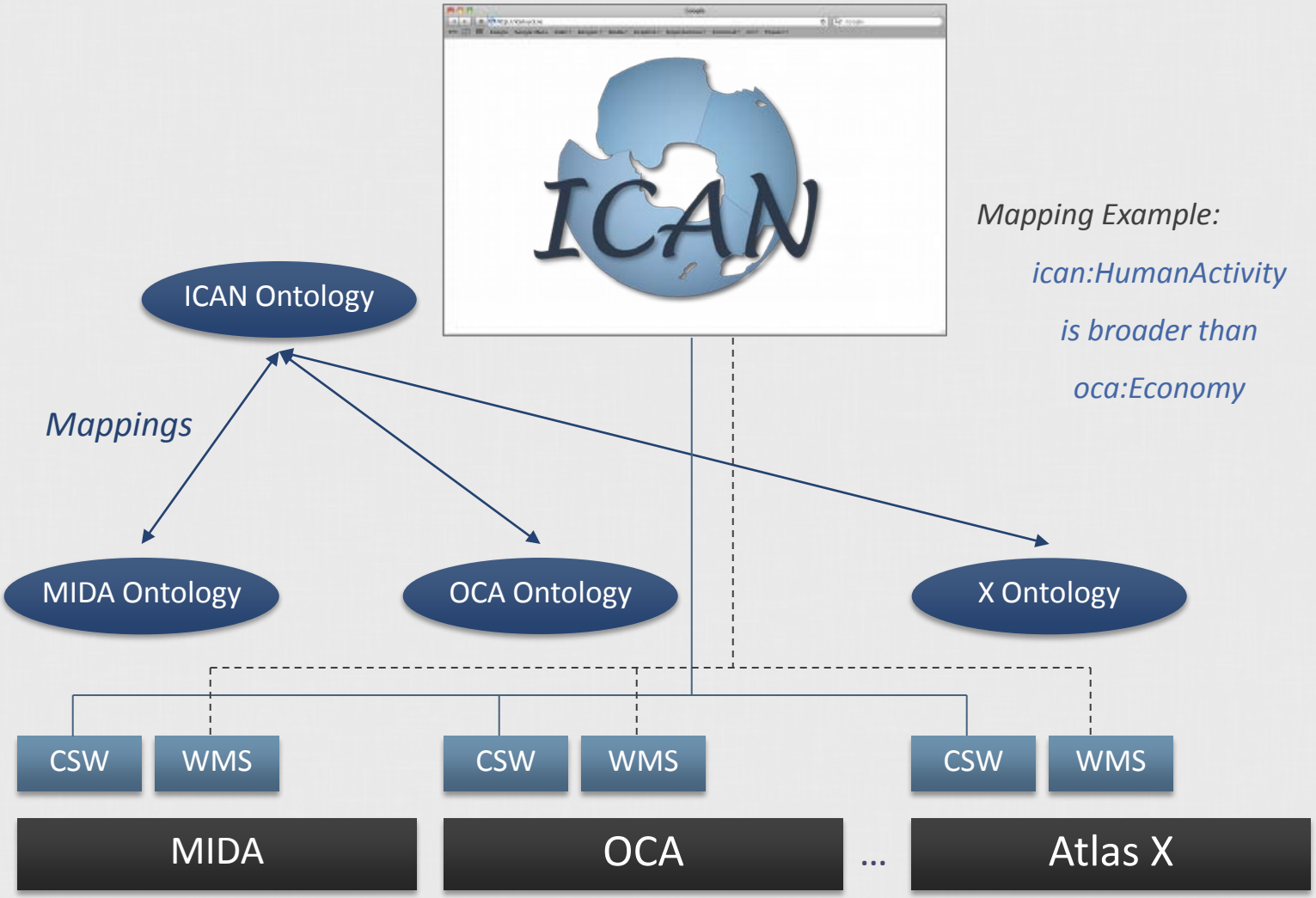
One database
Consistent semantics

Same query language
Same data model and format

Heterogeneous data sources

Standardisation vs. Mediation





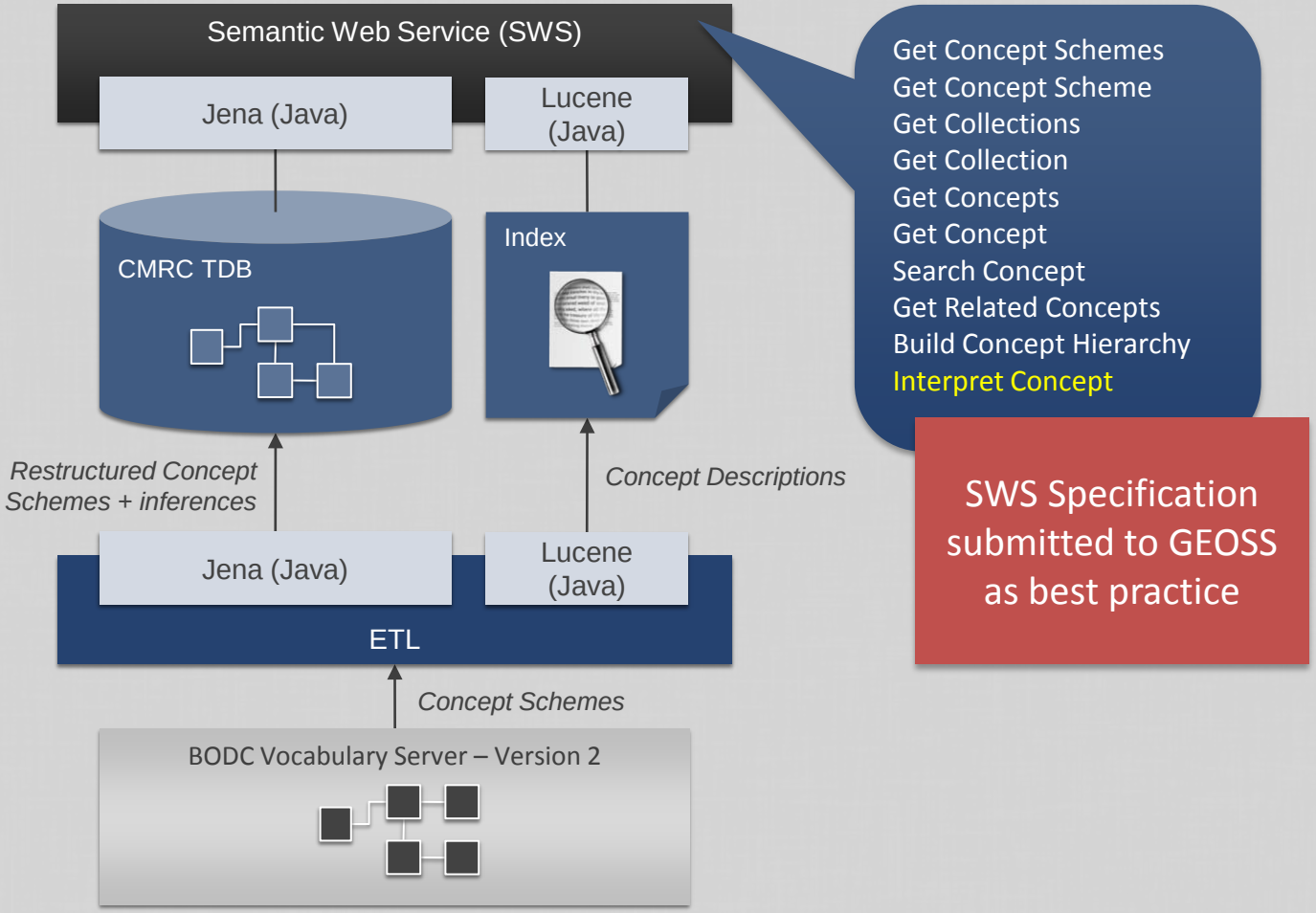
Mapping Example:

ican:HumanActivity

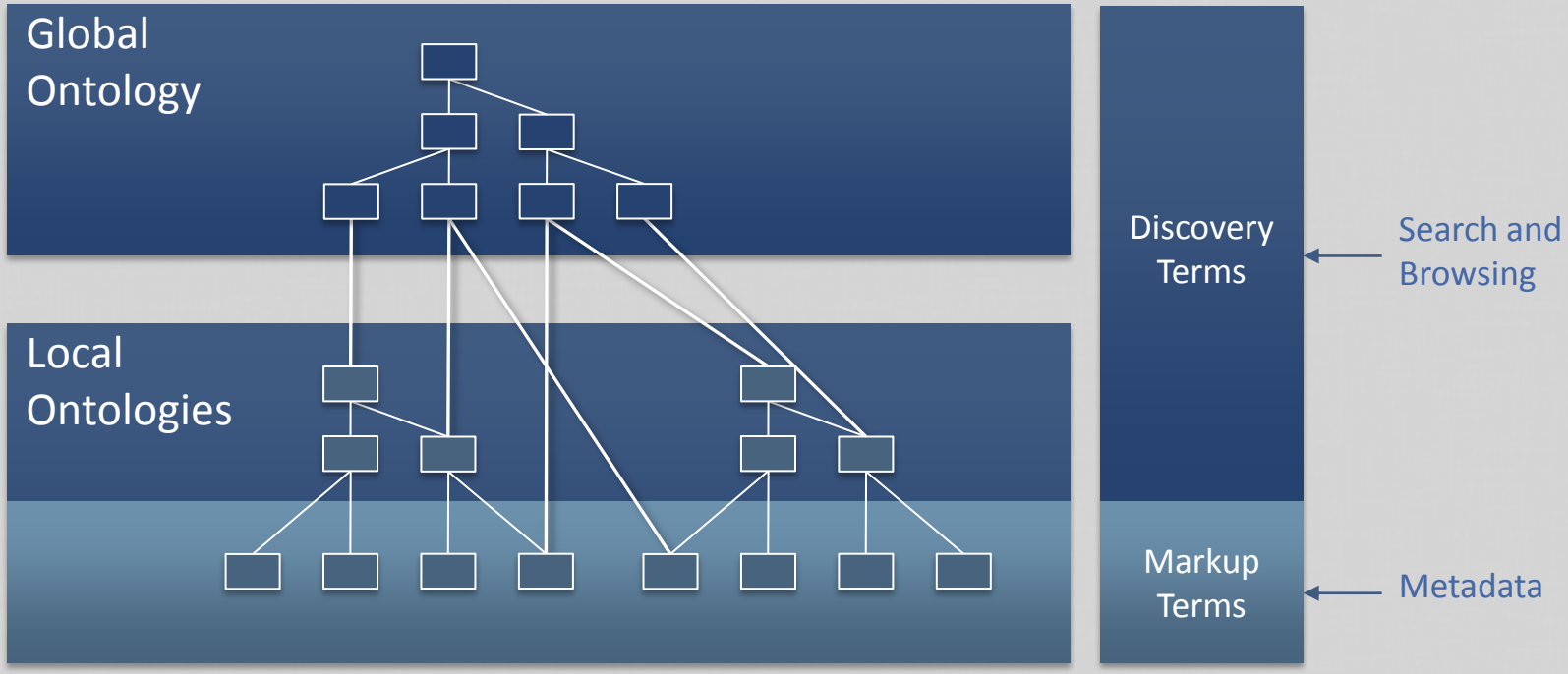
is broader than

oca:Economy

Semantic Framework



Ontology Structure



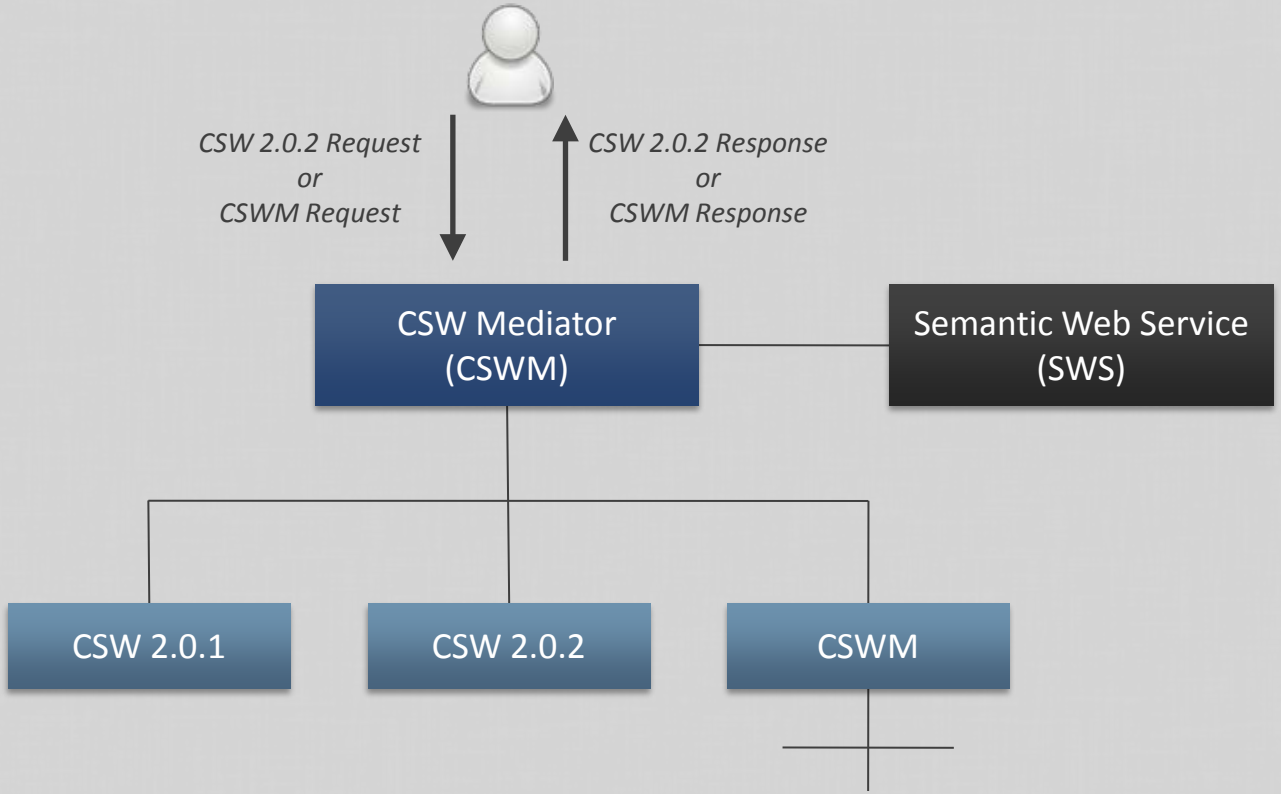
```
<rdf:RDF>
 <skos:Concept rdf:about="http://vocab.nerc.ac.uk/collection/A04/current/WavesAndTides/">
  <skos:inScheme rdf:resource="http://vocab.nerc.ac.uk/scheme/MIDA/current/"/>
  <skos:prefLabel xml:lang="en">Waves and Tides</skos:prefLabel>
  <skos:prefLabel xml:lang="es">Olas generadas en mar de fondo</skos:prefLabel>
  <skos:definition xml:lang="en">Waves constitute a moving ridge or swell over th
   Tides are the alternate rising and falling of the sea surface, caused by th
   fluid surface primarily by the Moon and the Sun.</skos:defini
  <skos:definition xml:lang="es">El oleaje de mar de f
   abierto por un evento meteorológico (ej. V
   oleaje están superpuestos a la a
   medida de las olas.</sk
  <skos:narrower>
   <skos:Concept rdf:abo
    <skos:inScheme rdf:re
    <skos:prefLabel xml:lan
    <skos:prefLabel xml:lang
    <skos:altLabel xml:lang="
    <skos:hiddenLabel xml:lang="en">Tide Guages</skos:altLabel>
    <skos:definition xml:lang="en">A measuring instrument used to measure the level (and extremes) of tidal
     movement of sea levels at a point on the Earths surface.</skos:definition>
    <skos:definition xml:lang="es">Instrumento de medición utilizado para medir el nivel medio (y los extremos) del
     movimiento de las mareas en un punto sobre la superficie de la tierra.</skos:definition>
   </skos:Concept>
  </skos:narrower>
  <!-- More related terms -->
 </skos:Concept>
 <!--More concepts-->
</rdf:RDF>
```

SKOS
RDF/XML
W3C

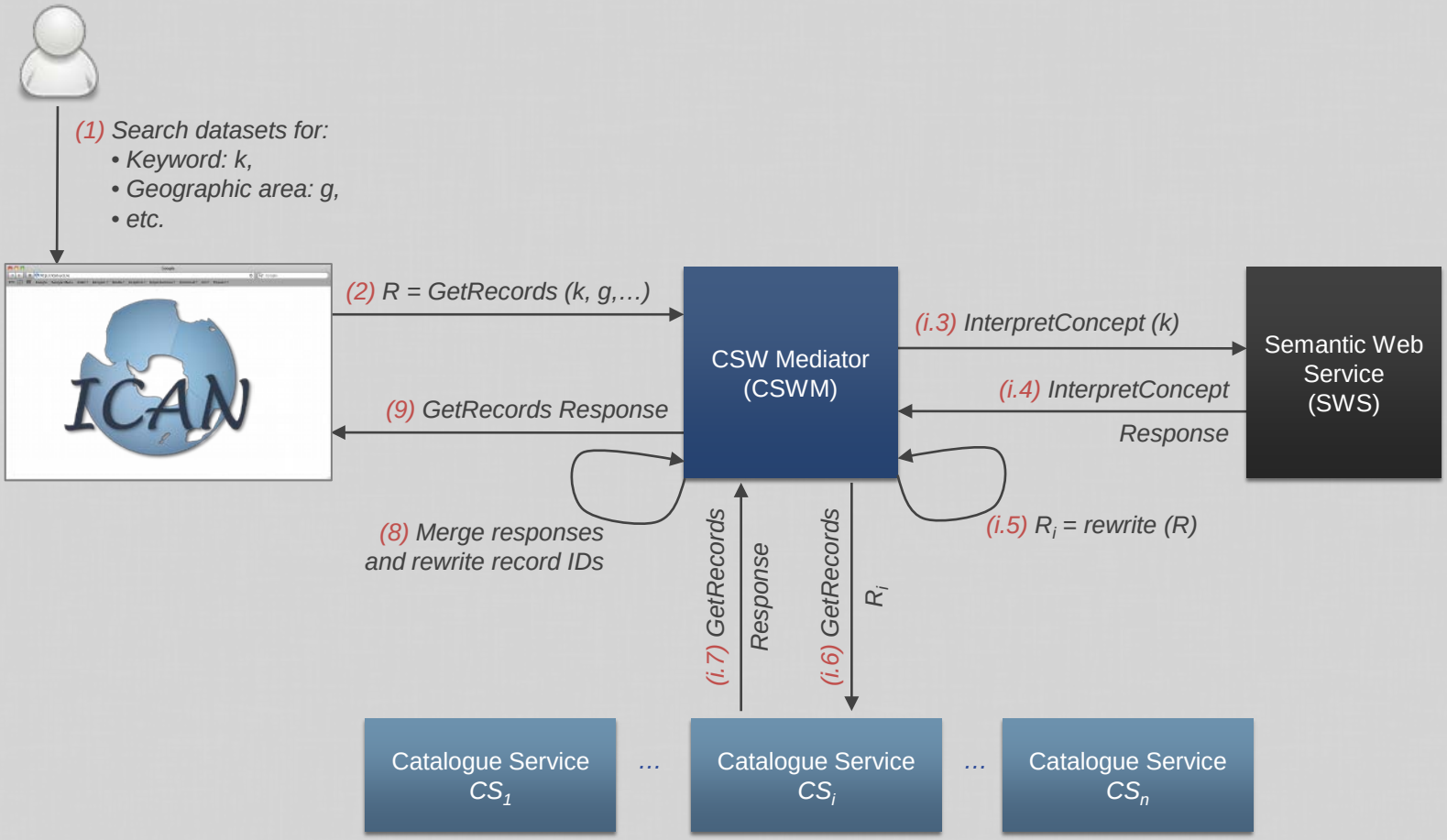
Semantic Annotations

```
<gmd:MD_Metadata>

  ...

  <!--A list of keywords from the local thesaurus-->
  <gmd:MD_Keywords>
    <!--One keyword-->
    <gmd:keyword>
      <gmx:Anchor
       xlink:href="http://vocab.nerc.ac.uk/collection/A04/current/Shipwrecks/">
       Shipwrecks
      <gmx:Anchor>
    </gmd:keyword>
    <!--You may include as many keywords as you wish-->
    ...
  </gmd:MD_Keywords>

  ...

</gmd:MD_Metadata>
```

CSW Mediation Architecture



CSW Mediation Work Flow



Query Rewriting

- Rewrite a user's request into requests supported by local catalogues
  - Translate query format
    - E.g., CSWM to CSW 2.0.2, CSW 2.0.2 to CSW 2.0.1, etc.
  - Translate term semantics

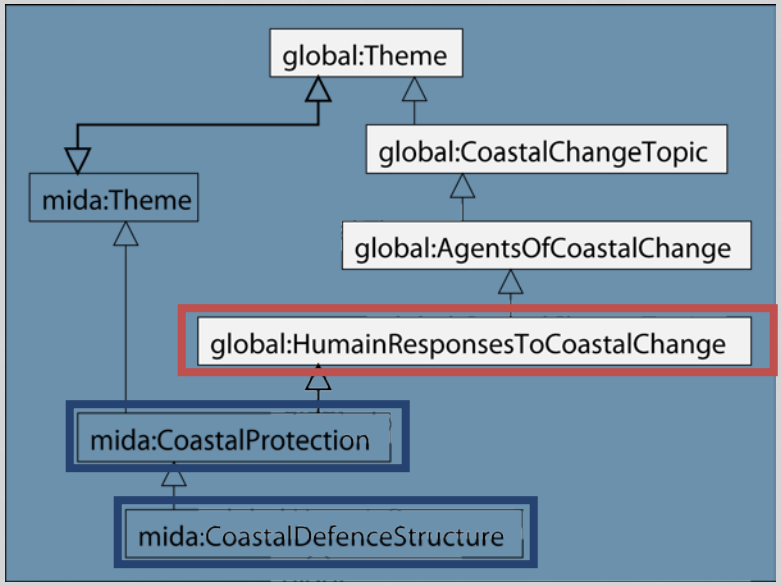
```
http://ican2.ucc.ie/icansrv/Explorer?
request=GetRecords&service=CSW&version=2.0.2
&resultType=results
&namespace=csw:http://www.opengis.net/cat/csw
&maxRecords=1000
&elementSetName=summary
&constraint=
<?xml version="1.0" encoding="UTF-8"?>
<Filter xmlns=http://www.opengis.net/ogc xmlns:gml=http://www.opengis.net/gml
   xmlns:csw="http://www.opengis.net/cat/csw/2.0.2">
    <And>
        <PropertyIsLike wildCard="%" singleChar="_" escape="\">
            <PropertyName>keyword</PropertyName>
            <Literal>HumanResponsesToCoastalChange%</Literal>
        </PropertyIsLike>
        <BBOX>
            <PropertyName>/csw:Record/ows:BoundingBox</PropertyName>
            <gml:Envelope
              srsName="http://www.opengis.net/gml/srs/epsg.xml#4326">
                <gml:lowerCorner>-180 -90</gml:lowerCorner>
                <gml:upperCorner>180 90</gml:upperCorner>
            </gml:Envelope>
        </BBOX>
    </And>
</Filter>
&constraintLanguage=FILTER
&constraint_language_version=1.1.0
```

```
http://ican2.ucc.ie/icansrv/Explorer?
request=GetRecords&service=CSW&version=2.0.2
&resultType=results
&namespace=csw:http://www.opengis.net/cat/csw
&maxRecords=1000
&elementSetName=summary
&constraint=
<?xml version="1.0" encoding="UTF-8"?>
<Filter xmlns=http://www.opengis.net/ogc xmlns:gml=http://www.opengis.net/gml
   xmlns:csw="http://www.opengis.net/cat/csw/2.0.2">
    <And>
        <PropertyIsLike wildCard="%" singleChar="_" escape="\">
            <PropertyName>keyword</PropertyName>
            <Literal>HumanResponsesToCoastalChange%</Literal>
        </PropertyIsLike>
        <BBOX>
            <PropertyName>/csw:Record/ows:BoundingBox</PropertyName>
            <gml:Envelope
              srsName="http://www.opengis.net/gml/srs/epsg.xml#4326">
                <gml:lowerCorner>-180 -90</gml:lowerCorner>
                <gml:upperCorner>180 90</gml:upperCorner>
            </gml:Envelope>
        </BBOX>
    </And>
</Filter>
&constraintLanguage=FILTER
&constraint_language_version=1.1.0
```

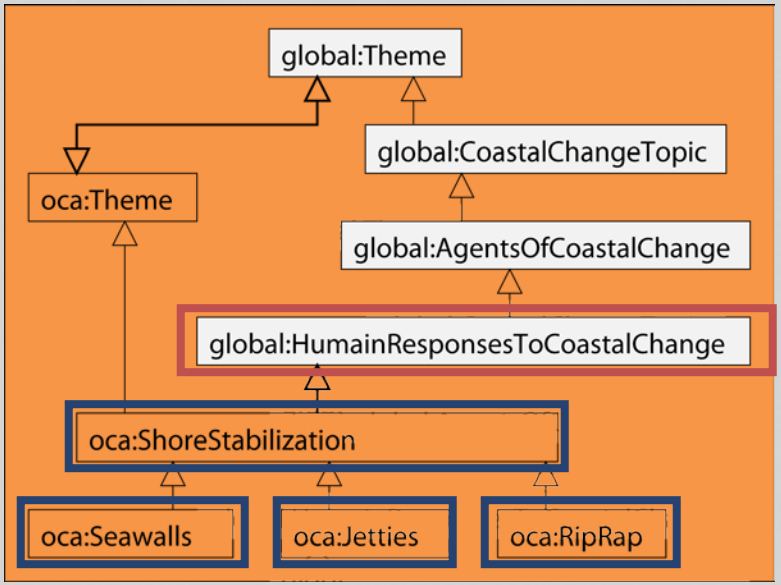
Term Translation

- CSW Mediator uses the semantic web service to translate (interpret) global terms into local terms

MIDA Mappings



OCA Mappings



Global

```
<PropertyIsLike wildCard="%“ singleChar="_" escape="\">
    <PropertyName>keyword</PropertyName>
    <Literal>HumanResponsesToCoastalChange%</Literal>
</PropertyIsLike>
```

MIDA

```
<Or>
    <PropertyIsLike wildCard="%“ singleChar="_"
      escape="\">
        <PropertyName>keyword</PropertyName>
        <Literal>CoastalProtection%</Literal>
    </PropertyIsLike>
    <PropertyIsLike wildCard="%“ singleChar="_"
      escape="\">
        <PropertyName>keyword</PropertyName>
        <Literal>CoastalDefenceStructure%</Literal>
    </PropertyIsLike>
</Or>
```

Improvements

- Standard ontology model: SKOS
- Multilingual ontologies
  - MIDA: English, Spanish
  - ICAN: English, Spanish, French, Norwegian, etc.
  - Smart multilingual search
- New ontology mappings:
  - MIDA - INSPIRE
  - MIDA - OCA
- New graphical user interface
  - Map viewer under development
- Improved performance:
  - Node requests processed in parallel
- Improved robustness and fixed bugs
- CSW Mediator has CSW 2.0.2 and CSWM 1.0 interfaces
- CSW Mediator supports CSW 2.0.1 and 2.0.2, and CSWM 1.0 nodes
- Improved code structure

Demo

HTTP://ICAN2.UCC.IE/ATLAS

Connecting Atlases

- Metadata delivered through CSW 2.0.2 (or 2.0.1)
- Metadata may use a controlled vocabulary
  - If so, controlled vocabulary (SKOS) needs to be stored in the NERC Vocabulary Server
  - You may want to reuse MIDA, and OCA vocabularies and extend them with new terms
- Metadata should point to WMS links

Connecting Atlases

- Cookbooks
  - Understanding Semantics
  - Understanding Metadata
  - Establishing a CSW metadata catalogue with GeoNetwork
  - Connecting your Atlas to the ICWA prototype

- Cookbooks can be downloaded from:

  http://netmar.nersc.no/sites/netmar.nersc.no/files/D7.9.2_ICAN_semantic_cookbooks_r2_20120731_0.pdf

Current Work

- Map viewer
- Connect more atlases
- Launch

Thanks

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