

The ICAN Prototype



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Outline

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- ICAN
- Problem
- Terminology
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- Query Rewriting
- Demonstration
- Progress to Date
- Conclusion
- Future Work

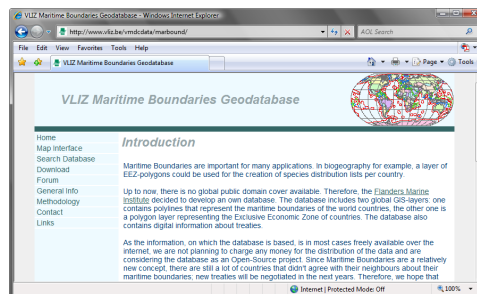
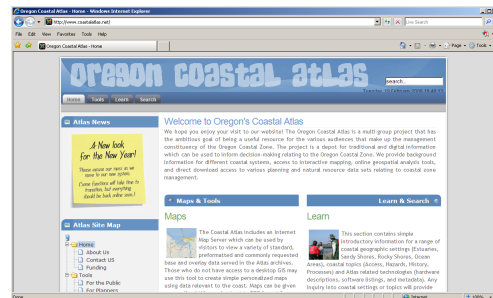
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Problem

- Interoperability of distributed autonomous and heterogeneous coastal Web atlases (CWA)

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Problem

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- Heterogeneity:
 - Syntactic (data formats, query languages)
 - Structural (data schemas)
 - Semantic (meaning of data values)
- E.g.:
 - Metadata:
 - Different metadata standards (ISO vs. FGDC)
 - Different terms: 'Seabed' vs. 'Seafloor'
'Coastline' vs. 'Shoreline'



Terminology

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- OGC Web Service:
 - OGC specification
 - Interface allowing requests for geographic “*resources*” across the Web using platform-independent calls
 - Main OGC services:
 - Catalogue Service for the Web (CSW)
 - Web Feature Service (WFS)
 - Web Coverage Service (WCS)
 - Web Map Service (WMS)



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- OGC Web Service:
 - Catalogue Service for the Web (CSW)
 - Allows requests for metadata across the Web
 - E.g. GeoNetwork is a CSW implementation

Request	Response
Get Capabilities	<i>Metadata about the types / operations the CSW supports</i>
Get Records	<i>Metadata records available, with possibility of filtering (bounding box, spatial, temporal, keywords search, etc.)</i>
Get Record By ID	<i>Record with the specified ID</i>

Terminology

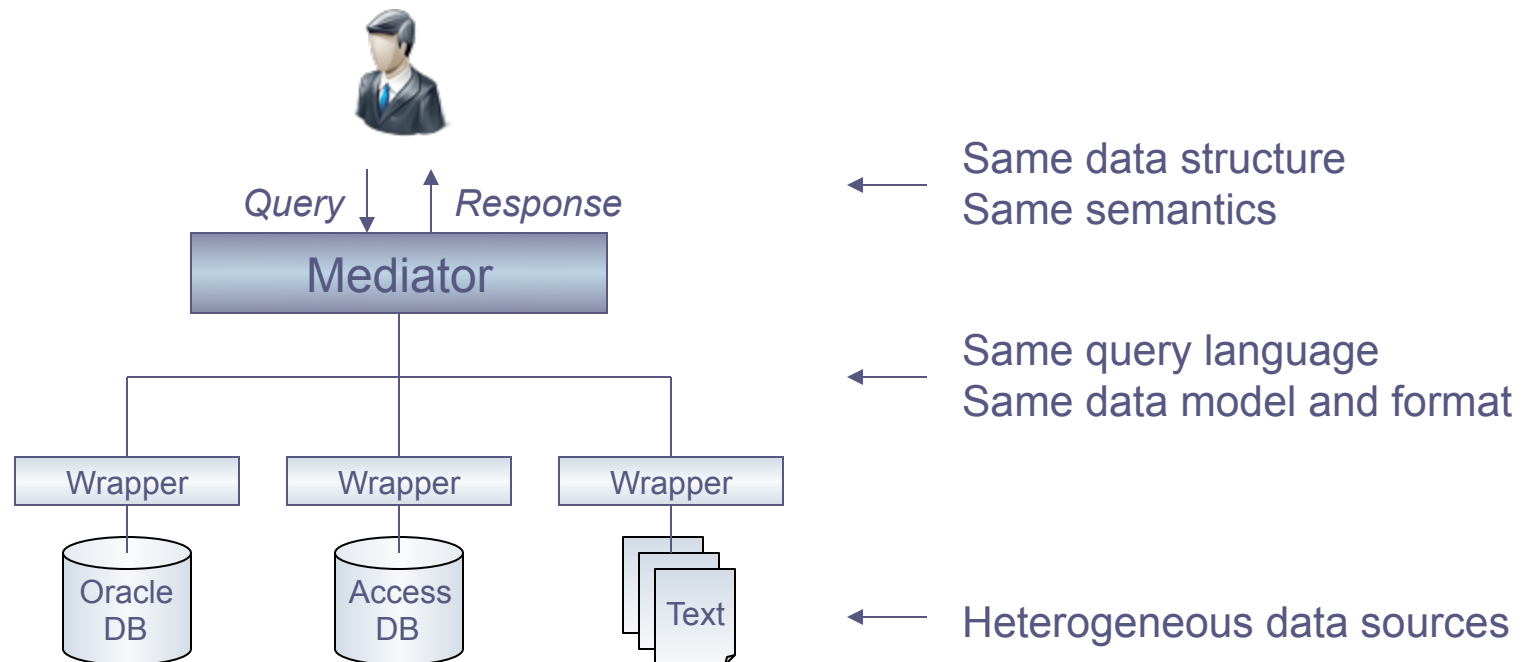
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- Ontologies:
 - A Knowledge Organisation System (KOS)
 - Define concepts (classes and objects)
 - Define relationships between concepts
 - Define inference rules
 - Examples:
 - John *is a* Person
 - Mary *is a* Person
 - Mary *is mother of* John
 - **If** (X *is father of* Y & Y *is father of* Z)
then X is grand-father of Z

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- Mediation:
 - A virtual data integration approach
 - Allows transparent access and integration of autonomous distributed heterogeneous data sources





Idea

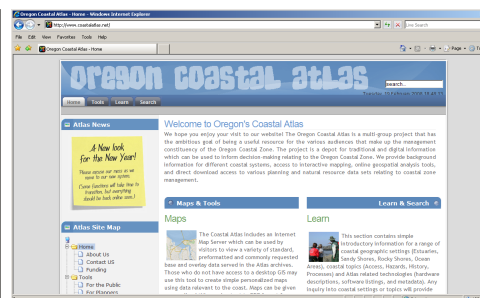
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- Connect individual coastal atlases to an integrated global atlas



Global atlas

Local atlases





Approach

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- Centralised system
 - Resources are accessed through one central system (ICAN global atlas)
- Virtual integration approach
 - Data are not copied into the global Atlas
- Local atlases autonomy
 - Each data atlas is autonomous and organises resources in its own way and uses its own terminology (ontology)



Approach

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- To achieve interoperability:
 1. Standardisation:
 - Standardise access interfaces and resource formats
 - Implement OGC Web Services
 - » Catalogue Service for the Web (CSW)
 - » Web Feature Service (WFS)
 - » Web Coverage Service (WCS)
 - » Web Map Service (WMS)
 - Support ISO metadata standards
 - » ISO-19115 & ISO-19139
- Standardise Web querying and delivery formats



Approach

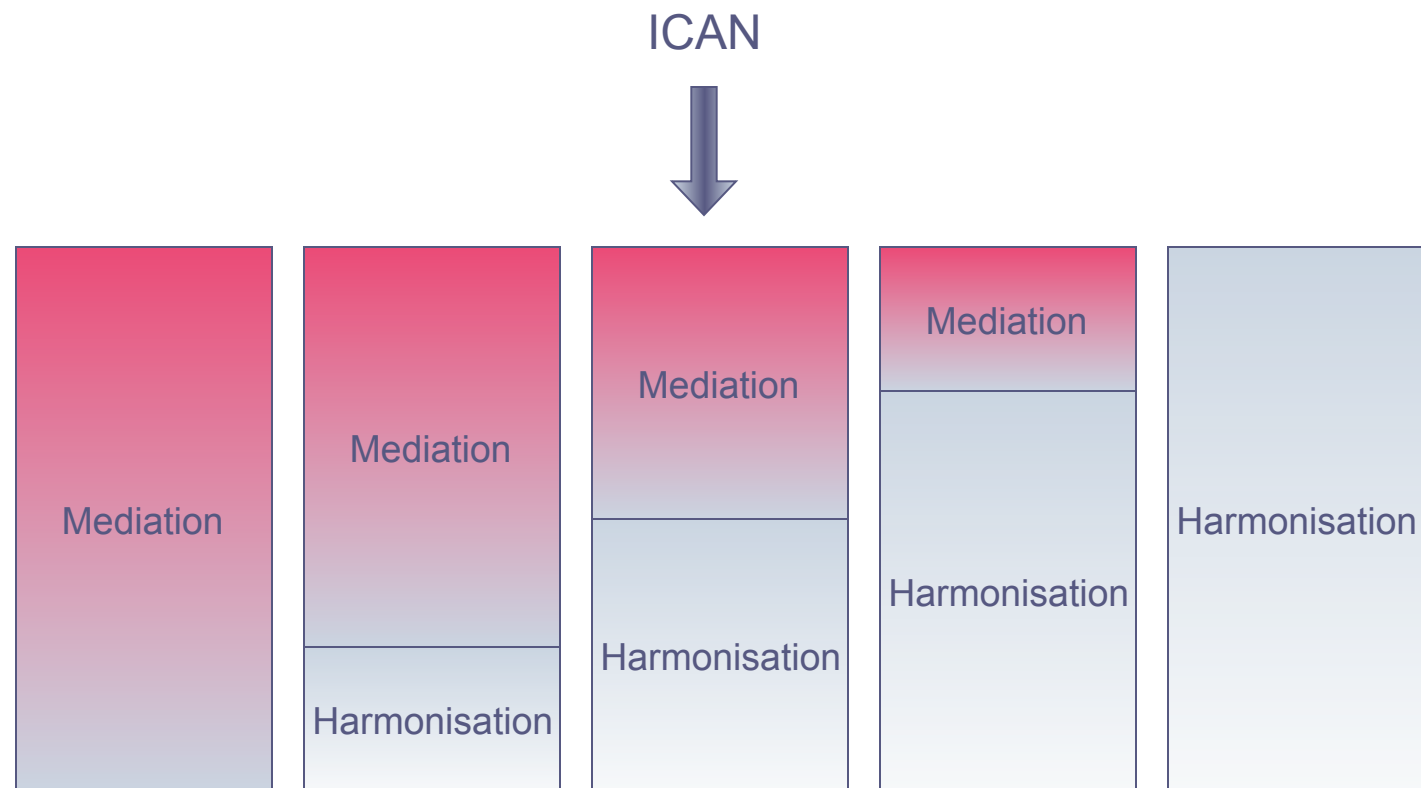
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- To achieve interoperability:
 2. Mediation:
 - Allow local atlases to use their own data structures, semantics and vocabularies (ontologies)
 - Use a common data structure and a common ontology for the global atlas
 - Provide mappings (translations) between local ontologies and the global ontology

Approach

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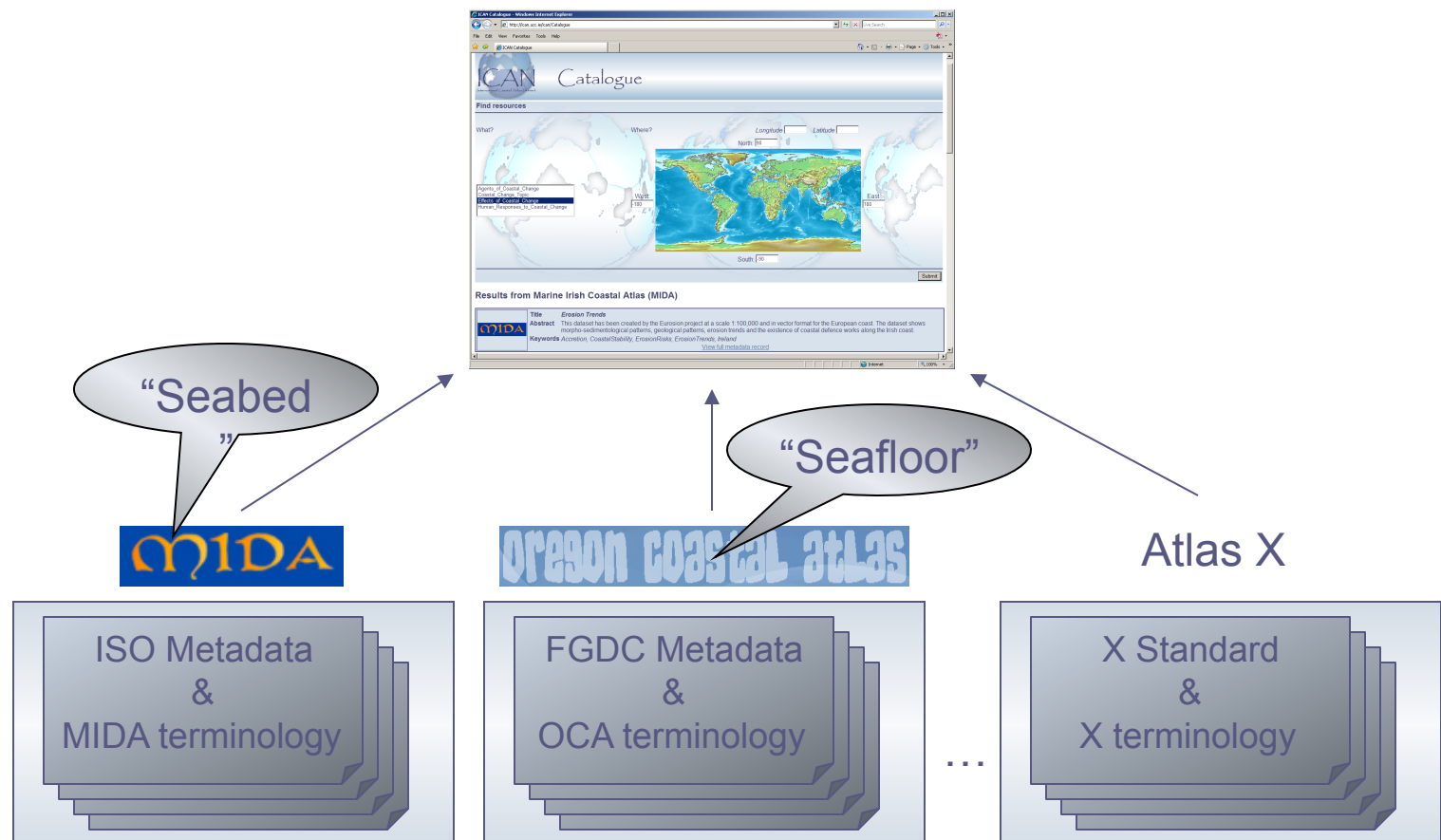
Harmonisation vs. Mediation



Approach

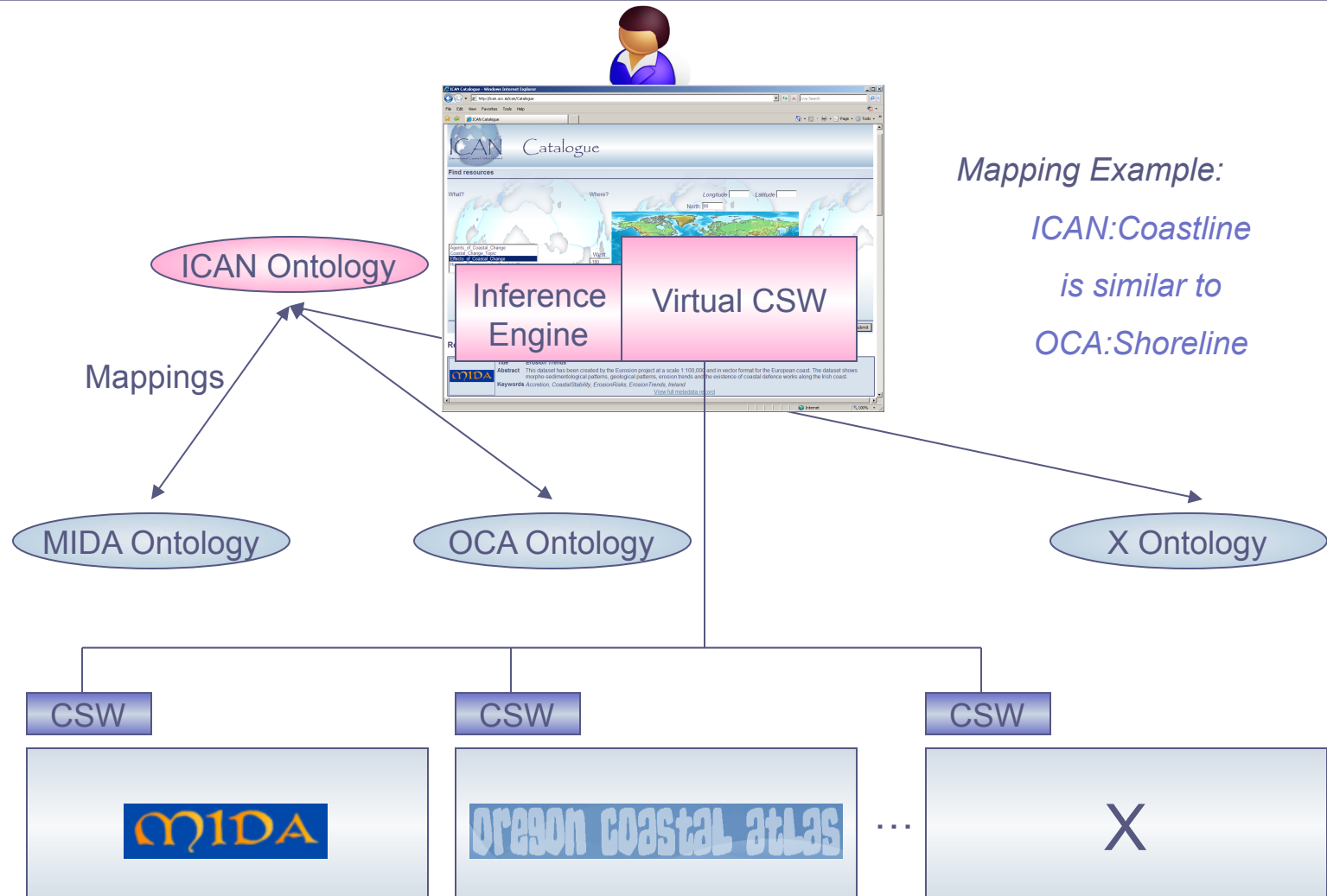
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- We focus on Metadata interoperability



Architecture

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Local and Global Ontologies

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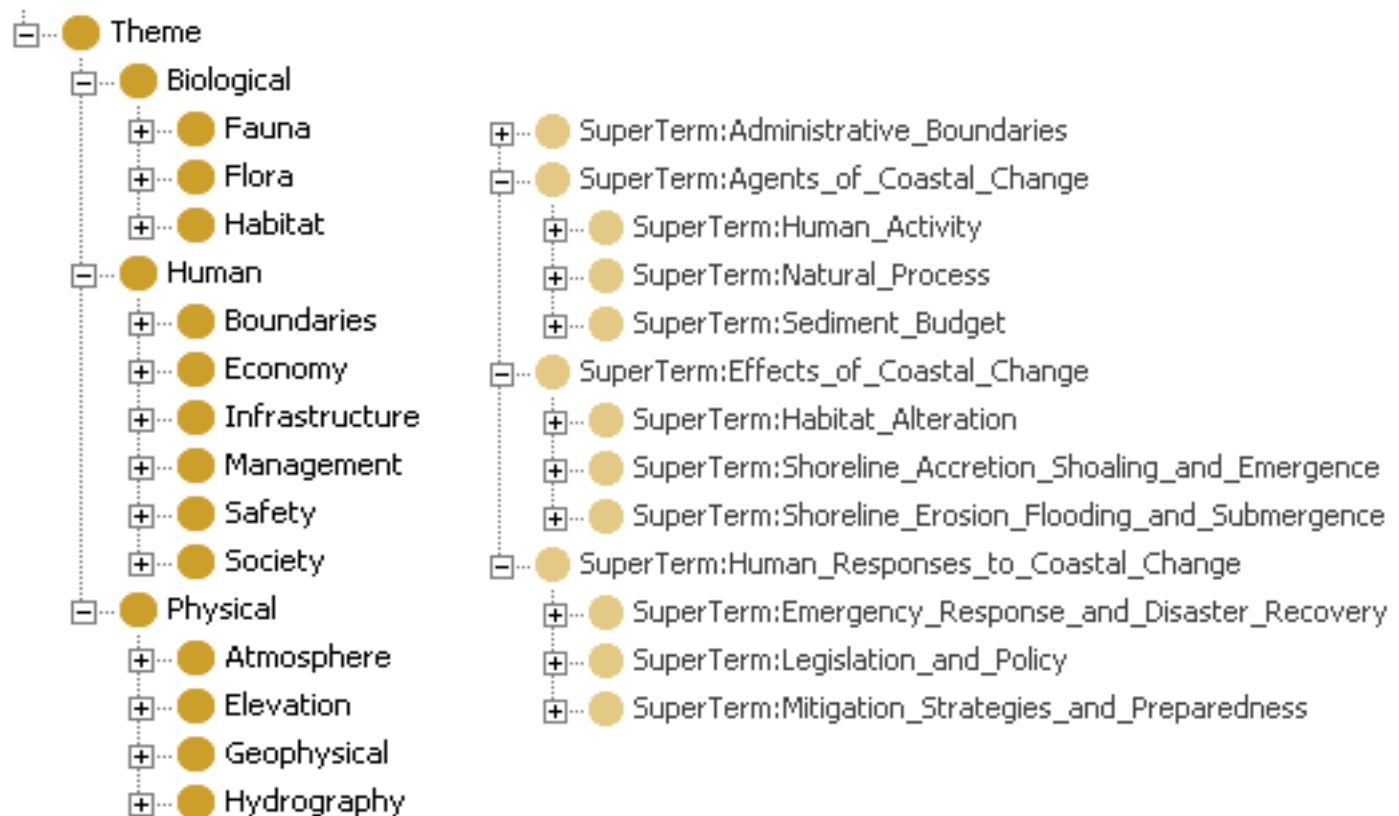
- A global ontology represents the keywords used in the virtual ICAN catalogue service
- For each atlas X, a local ontology represents the keywords used by the X catalogue service
- Five types of keywords (ISO-19115): Theme, Discipline, Place, Temporal, Stratum



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Local Ontology (OCA)

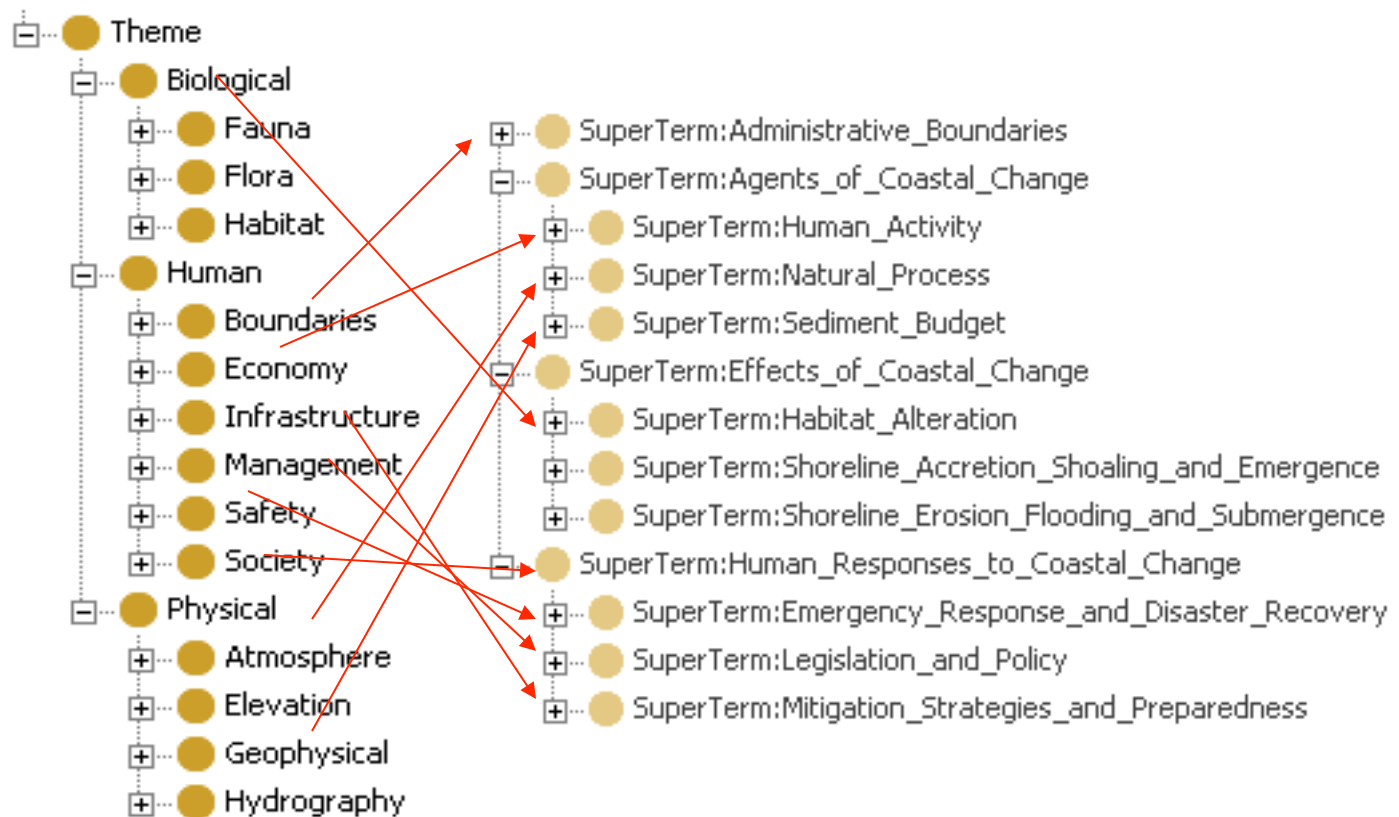


Global Ontology

Ontology Mappings

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Local Ontology (OCA)

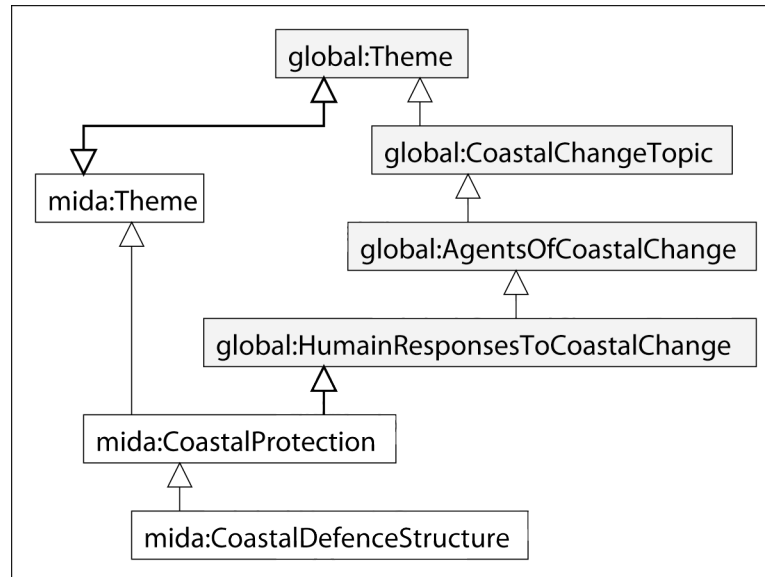


Global Ontology

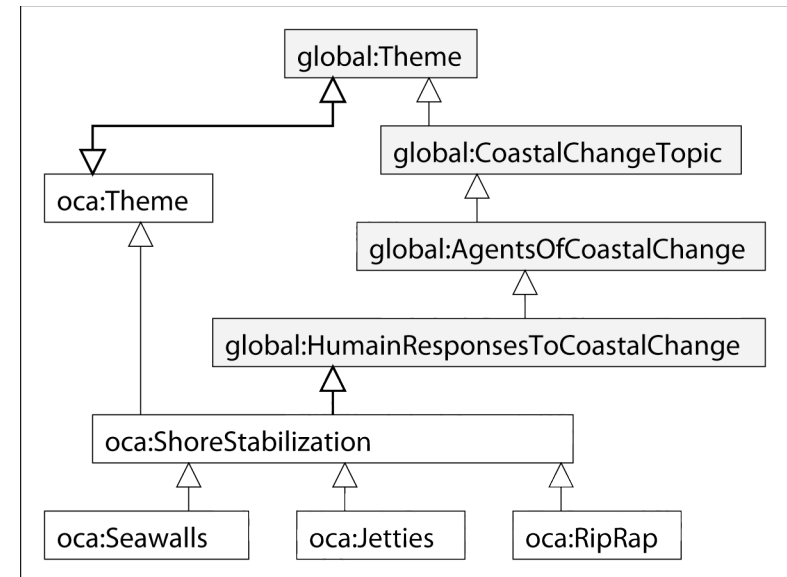
Ontology Mappings

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MIDA Mappings



OCA Mappings



Each mappings file is an OWL ontology



Atlas Connection

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5 Steps to connect your atlas to ICAN:

- CSW
- Local ontology
- Ontology mappings
- Metadata using ontology terms as keywords
- Registration

Atlas

ICAN

Atlas Connection

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• Atlases

	CSW (2.0.1)	Local Ontology	Ontology Mappings	Metadata Using Ontology	Registration
MIDA	✓	✓	✓	✓	✓
OCA	✓	✓	✓	✓	✓
MarBound	(✓)	✓	✓	✓	(✓)
WashCA		✓		✓	
WisCA	✓	✓	✓	✓	



Query Rewriting

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- Rewrite user's request into requests supported by local CSWs



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```
http://ican.ucc.ie/srv/en/csw?request=GetRecords&service=CSW&version=2.0.1
&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
```



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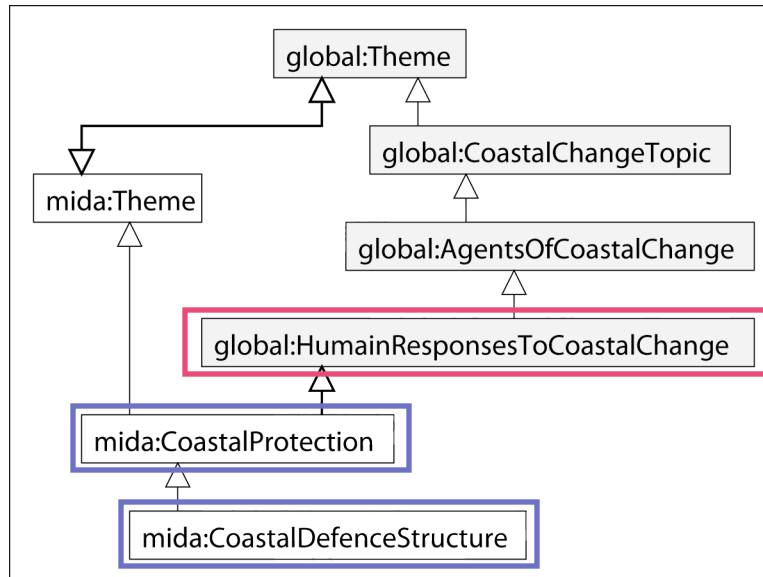
```
http://ican.ucc.ie/srv/en/csw?request=GetRecords&service=CSW&version=2.0.1
&resultType=results&namespace=csw:http://www.opengis.net/cat/csw&maxRecords=1000
&elementSetName=summary
&constraint=
<?xml version="1.0" encoding="UTF-8"?>
<Filter xmlns=http://www.opengis.net/ogc xmlns:gml=http://www.opengis.net/gml
  xmlns:csw="http://www.opengis.net/cat/csw/2.0.2">
  <And>
    <PropertyIsLike wildCard="% " singleChar="_" escape="\ ">
      <PropertyName>keyword</PropertyName>
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      <gml:Envelope srsName="http://www.opengis.net/gml/srs/epsg.xml#4326">
        <gml:lowerCorner>-180 -90</gml:lowerCorner>
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  </And>
</Filter>
&constraintLanguage=FILTER
&constraint_language_version=1.1.0
```


Query Rewriting

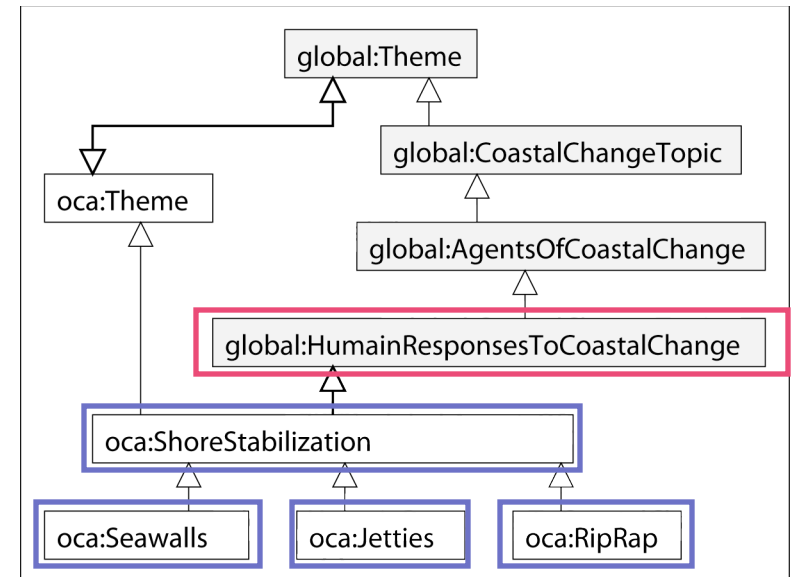
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Mediator uses inference engine to translate global terms into local terms

MIDA Mappings



OCA Mappings



Query Rewriting

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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>
```



Demonstration

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<http://ican.ucc.ie>





Demonstration



ICAN Catalogue



Network



Administration



Event Monitor

Introduction

– □ ×

Welcome to the ICAN Atlas Mediator v.2.0 !

Please note: This site is a prototype still in development.

This tool is designed as a proof-of-concept to demonstrate how Coastal Web Atlases from different parts of the world can be linked. It demonstrates an easy way to search for coastal geographic data from any atlas that is connected to the ICAN Prototype.

This prototype focuses on a Coastal Erosion use case for demonstration purposes. Ontologies are used to connect metadata databases about geographic data. Each Coastal Web Atlas has independent ontologies of their coastal erosion data. Each are mapped to the ICAN global coastal erosion ontology. These ontologies work behind-the-scenes to simplify searching of multiple atlases at once. Think of this web page as your computer desktop. You use it in a similar way.

To begin, simply select one of the icons on the right of the window:

- ICAN Catalogue: Search multiple Coastal Web Atlases at one time.
- Network: Search one Coastal Web Atlas in the ICAN Network.
- Administration: For Administrators only.
- Event Monitor: See what happens in the background when you search.

For more information about ICAN and this prototype, please visit <http://www.icoastlatlas.net>. To provide feedback, please submit a comment in the ICAN Discussion Room [link: <http://ican.science.oregonstate.edu/forum>] under Technology and Data.

Thanks,

Close

International Coastal Atlas Network



18:27



Demonstration



ICAN Catalogue



Network



Administration



Event Monitor

ICAN
International Coastal Atlas Network



18:25



Demonstration



Open the ICAN Catalogue



Network



Administration



Event Monitor

ICAN
International Coastal Atlas Network



18:28



Demonstration



ICAN Catalogue



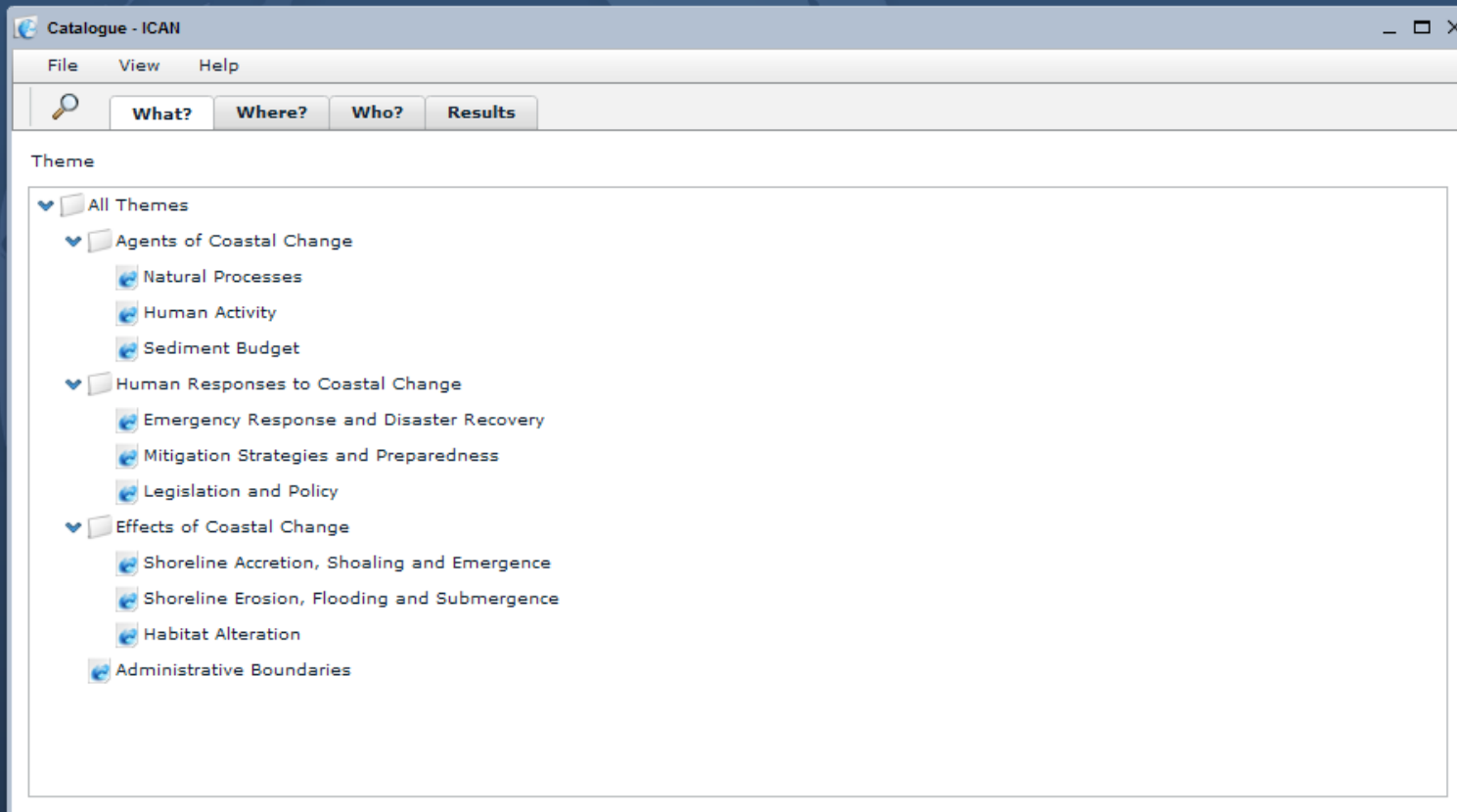
Network



Administration



Event Monitor



18:30



Demonstration



ICAN Catalogue



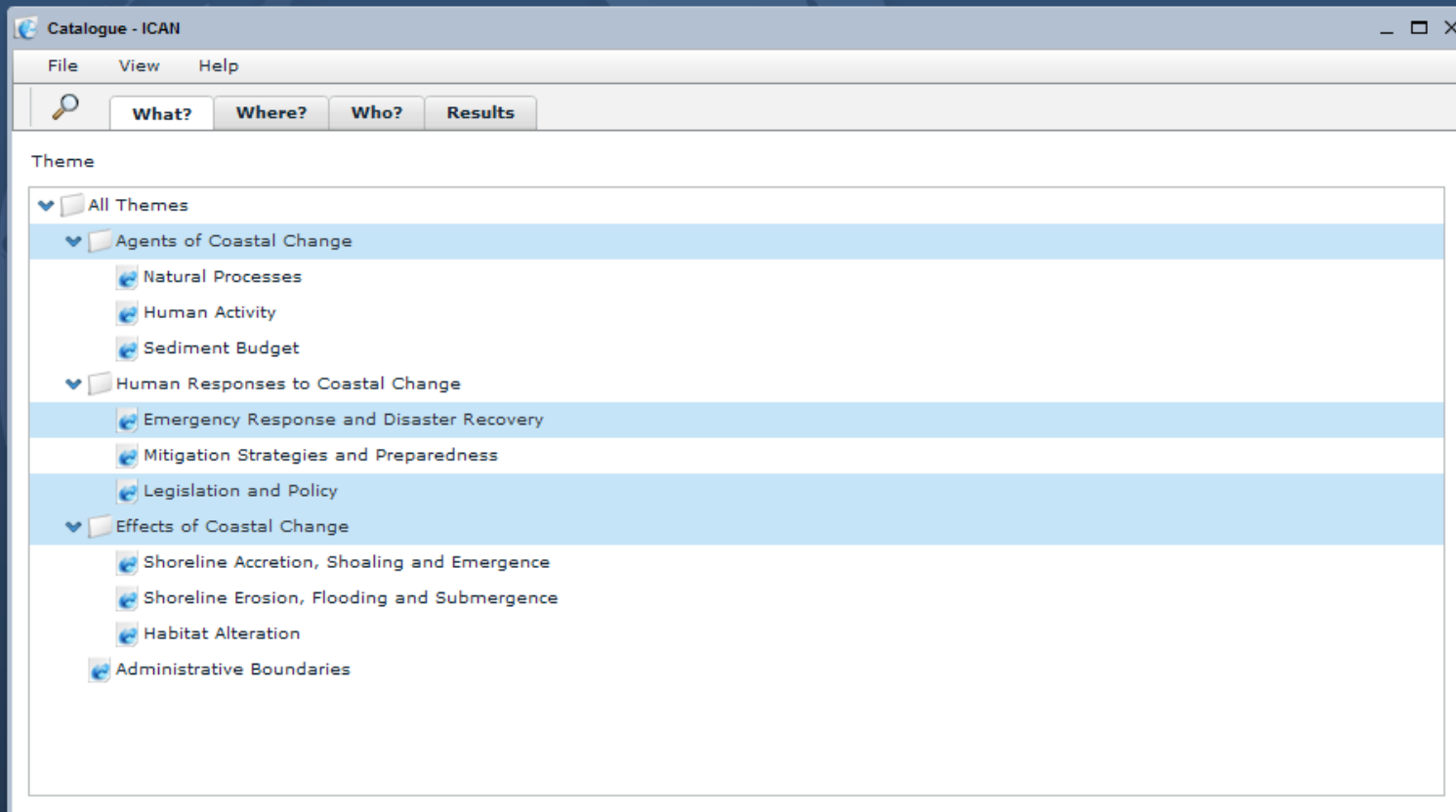
Network



Administration



Event Monitor



18:37



Demonstration



ICAN Catalogue



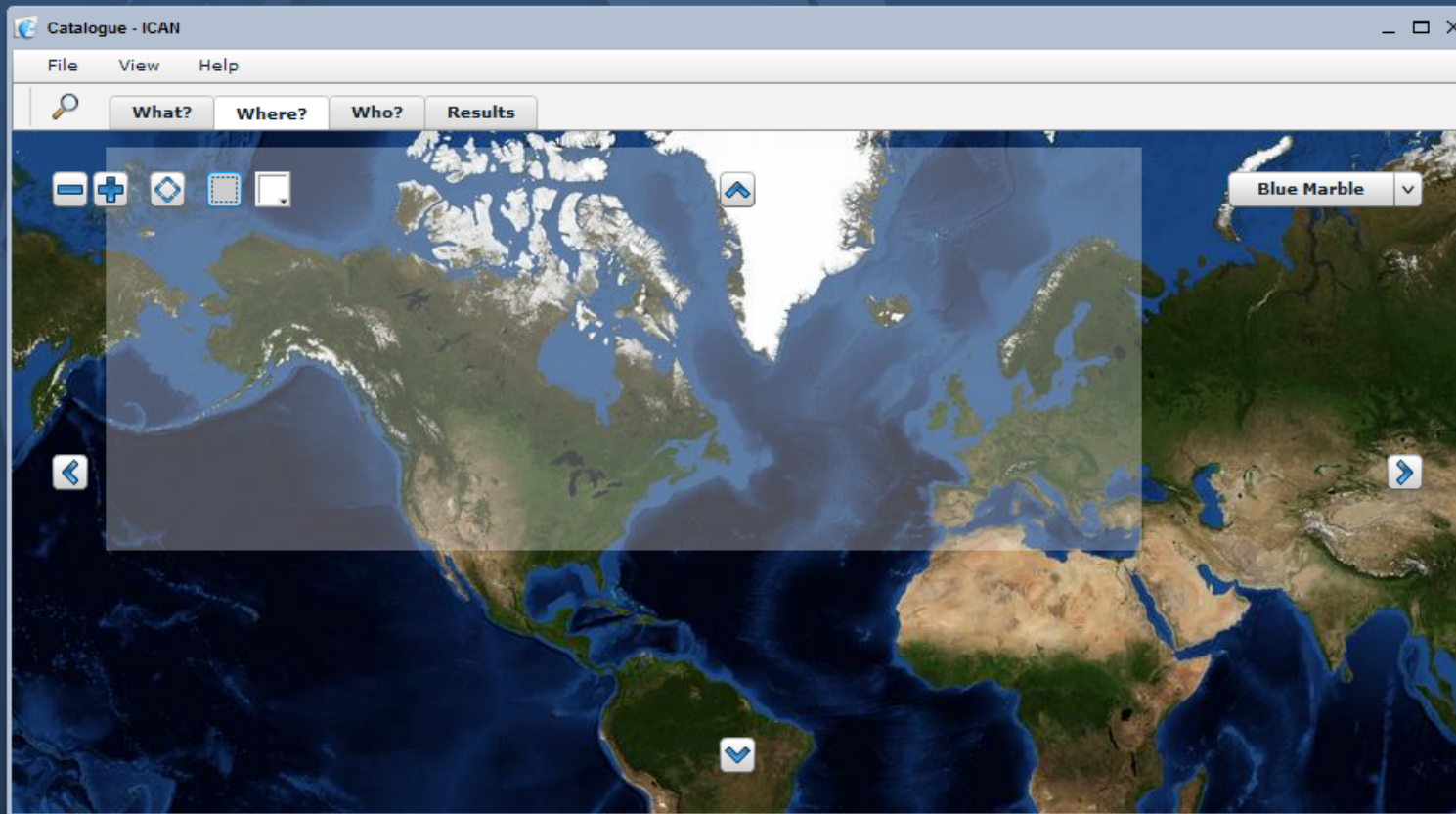
Network



Administration



Event Monitor



18:33



Demonstration



ICAN Catalogue



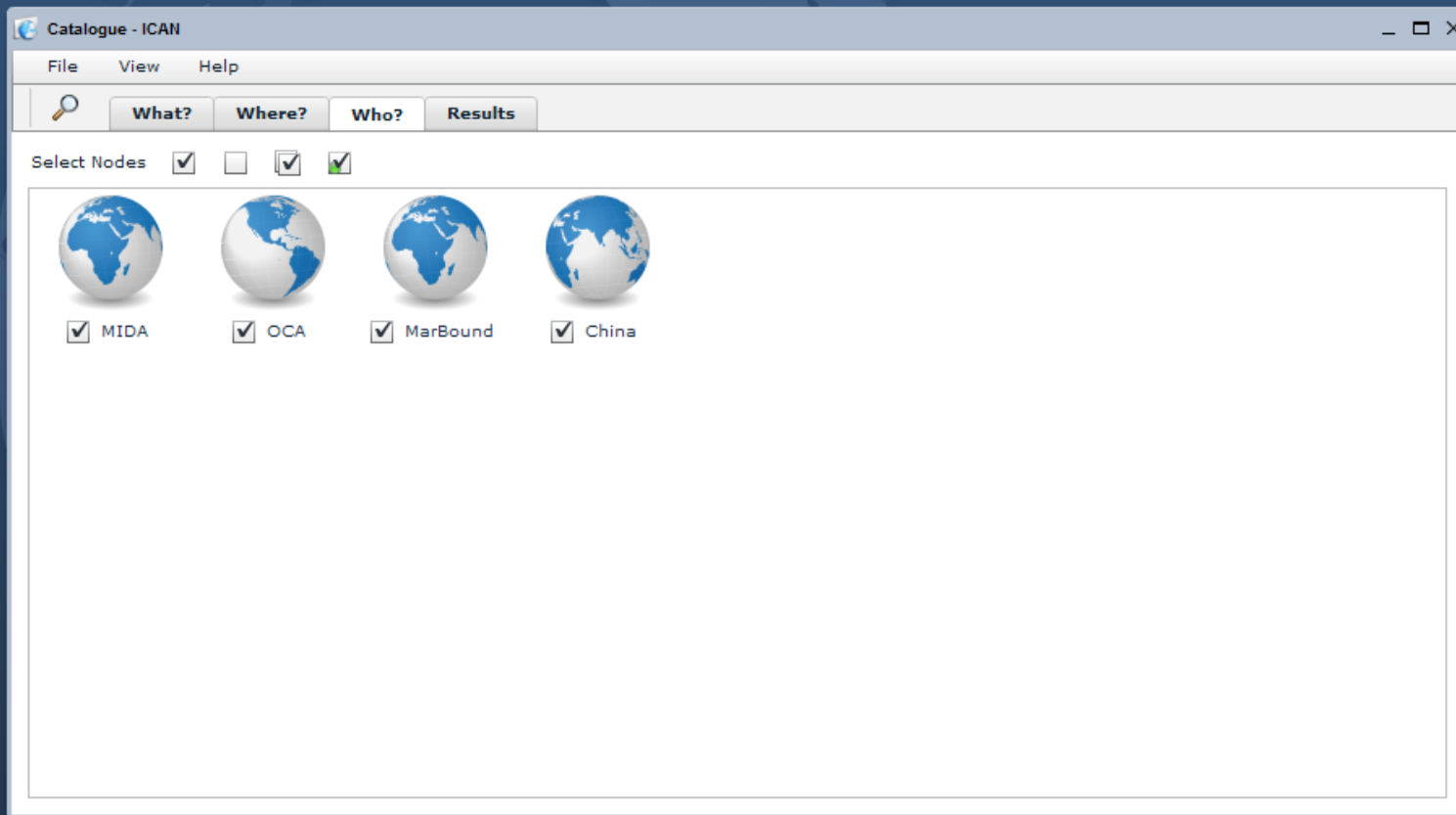
Network



Administration



Event Monitor



18:34



Demonstration



ICAN Catalogue



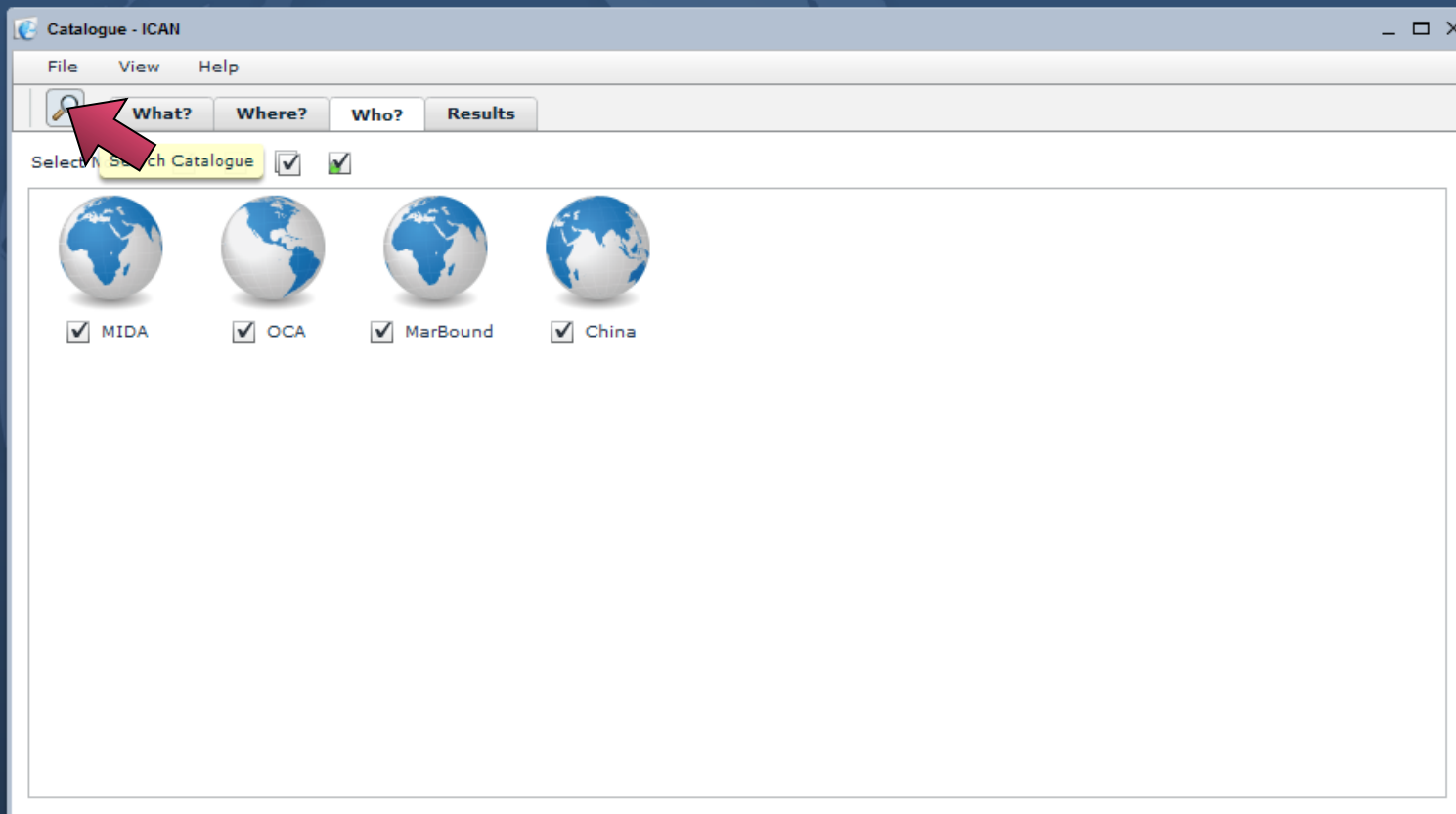
Network



Administration



Event Monitor



18:35



Demonstration



ICAN Catalogue



Network



Administration







Event Monitor

Catalogue - ICAN

File View Help

What? Where? Who? Results

Atlas	Title	Abstract	Keywords
	Coastal Geology	This dataset has been created by the EuroSION project at a scale 1:100,000 and in vector format for the European coast. The dataset shows morpho-sedimentological patterns, geological patterns, erosion trends and the existence of coastal defence works along the Irish coast.	SurfaceGeology, Ireland
	Coastal Geomorphology	This dataset has been created by the EuroSION project at a scale 1:100,000 and in vector format for the European coast. The dataset shows morpho-sedimentological patterns, geological patterns, erosion trends and the existence of coastal defence works along the Irish coast.	CoastalTypology, NaturalCoastalFeatures, Ireland
	Coastal Vulnerability to Sea-Level Rise: A Preliminary Database for the U.S. Pacific Coast, USGS, 2001	The goal of this project is to provide a preliminary overview, at a National scale, the relative susceptibility of the Nation's coast to sea-level rise through the use of a coastal vulnerability index (CVI). This initial classification is based upon the variables geomorphology, regional coastal slope, tide range, wave height, relative sea-level rise and shoreline erosion and accretion rates. The combination of these variables and the association of these variables to each other furnish a broad overview of regions where physical changes are likely to occur due to sea-level rise.	Tide Range, Wave Height, Beach Erosion, Erosion, CommunityVulnerability...
	Oregon Statutory Vegetation Line (ORS 390.77)	This shapefile represents the line of the statutory vegetation line based on ORS 390.77. This is a jurisdictional line that determines the regulatory authority of Oregon State Parks and Recreation to regulate development on the beach.	statutory vegetation line, Erosion, PublicTrustResources, ocean shore, Goal18...
		This dataset is a mapped inventory of ocean front tax lots and the status of their eligibility for shoreline protective structure (SPS) permits. Under Statewide Planning Goal 18, Implementation Requirement #5, SPS may be permitted only where development existed on January 1, 1977. Development is defined as	

45 Elements



18:39



Demonstration



ICAN Catalogue



Network







Administration



Event Monitor

Catalogue - ICAN
File View Help

What? Where? Who? Results


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18:39


Demonstration




ICAN Catalogue



Network



Administration




Event Monitor

Metadata Viewer - Coastal Geomorphology

Summary

ISO 19139



Coastal Geomorphology

19f030c5-acf5-4fbe-9699-176b1404fe6b

Keywords CoastalTypology, NaturalCoastalFeatures, Ireland

Source MIDA (<http://mida.ucc.ie>)

Language eng


Rights copyright,otherRestrictions

This dataset has been created by the EuroSION project at a scale 1:100,000 and in vector format for the European coast. The dataset shows morpho-sedimentological patterns, geological patterns, erosion trends and the existence of coastal defence works along the Irish coast.

Close

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November 2009

ICAN Workshop 4 – Trieste

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Demonstration



ICAN Catalogue



Network



Administration



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Metadata Viewer - Coastal Geomorphology

Summary ISO 19139

```
<gmd:MD_Metadata xmlns:gmd="http://www.isotc211.org/2005/gmd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:gml="http://www.opengis.net/gml" xmlns:gts="http://www.isotc211.org/2005/gts" xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:csw="http://www.opengis.net/cat/csw">
  <gmd:fileIdentifier>
    <gco:CharacterString>19f030c5-acf5-4fbe-9699-176b1404fe6b</gco:CharacterString>
  </gmd:fileIdentifier>
  <gmd:language>
    <gco:CharacterString>eng</gco:CharacterString>
  </gmd:language>
  <gmd:characterSet>
    <gmd:MD_CharacterSetCode codeListValue="utf8" codeList="/resources/codeList.xml#MD_CharacterSetCode"/>
  </gmd:characterSet>
  <gmd:contact>
    <gmd:CI_ResponsibleParty>
      <gmd:individualName>
        <gco:CharacterString>Kathrin Kopke</gco:CharacterString>
      </gmd:individualName>
      <gmd:organisationName>
        <gco:CharacterString>CMRC</gco:CharacterString>
      </gmd:organisationName>
      <gmd:positionName>
        <gco:CharacterString>Environmental Scientist</gco:CharacterString>
      </gmd:positionName>
      <gmd:contactInfo>
        <gmd:CI_Contact>
          <gmd:phone>
            <gmd:CI_Telephone>
              <gmd:voice>
                <gco:CharacterString/>
              </gmd:voice>
            </gmd:CI_Telephone>
          </gmd:phone>
        </gmd:CI_Contact>
      </gmd:contactInfo>
    </gmd:CI_ResponsibleParty>
  </gmd:contact>
</gmd:MD_Metadata>
```

Close

This dataset is a mapped inventory of ocean front tax lots and the status of their eligibility for shoreline protective structure (SPS) permits. Under Statewide Planning Goal 18, Implementation Requirement #5, SPS may be permitted only where development existed on January 1, 1977. Development is defined as

45 Elements



Demonstration



ICAN Catalogue



Network



Administration



Open Event Monitor

Event Monitor

ICAN
International Coastal Atlas Network



Metadata Viewer - Co...

Catalogue - ICAN

18:42



Demonstration



ICAN Catalogue



Network



Administration



Event Monitor

```
ICAN - Event Monitor
File View Help
ICAN> GetRecords request received
ICAN> -- Selected nodes: All
ICAN> -- Loading atlas registry file [Success]
ICAN> -- Processing query for MIDA
ICAN> ---- Loading ontologies and inferencing mappings for MIDA [Success]
ICAN> ---- Translating client keywords and rewriting global query [Success]
ICAN> ---- Executing local query [Success]
ICAN> ---- MIDA: 35 results returned
ICAN> ---- Done
ICAN> -- Processing query for OCA
ICAN> ---- Loading ontologies and inferencing mappings for OCA [Success]
ICAN> ---- Translating client keywords and rewriting global query [Success]
ICAN> ---- Executing local query [Success]
ICAN> ---- OCA: 10 results returned
ICAN> ---- Done
ICAN> -- Processing query for MarBound
ICAN> ---- Loading ontologies and inferencing mappings for MarBound [Success]
ICAN> ---- Translating client keywords and rewriting global query [Success]
ICAN> ----- MarBound will not be queried: No matching keywords or spatial extent
ICAN> ---- Done
ICAN> -- Processing query for China
```

International Coastal Atlas Network



Metadata Viewer - Co...

Catalogue - ICAN

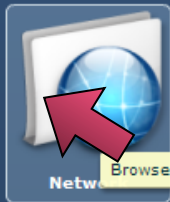
18:44



Demonstration



ICAN Catalogue



Netw



Administration



Event Monitor

ICAN
International Coastal Atlas Network



Metadata Viewer - Co...



Catalogue - ICAN



ICAN - Event Monitor

18:45



Demonstration



ICAN Catalogue



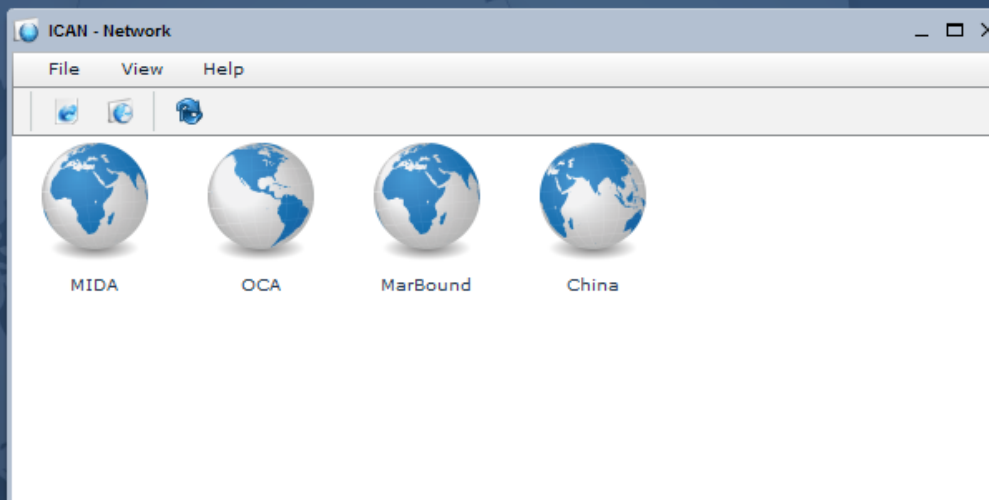
Network



Administration



Event Monitor



International Coastal Atlas Network



Metadata Viewer - Co...

Catalogue - ICAN

ICAN - Event Monitor

18:47



Demonstration



ICAN Catalogue



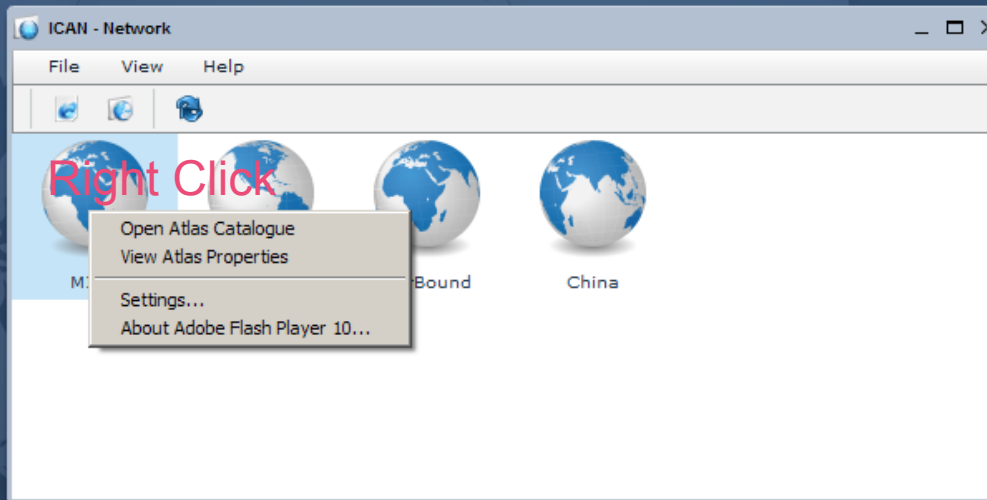
Network



Administration



Event Monitor



Metadata Viewer - Co...



Catalogue - ICAN



ICAN - Event Monitor

18:48



Demonstration

ICAN Catalogue

Network

Administration

Event Monitor

Node Properties - MIDA

General **Advanced**

MIDA
Marine Irish Digital Atlas

Organization Coastal and Marine Resources Centre (CMRC) - University College Cork (UCC)

Town Cork

State

Ireland

The Marine Irish Digital Atlas (MIDA) is a comprehensive resource for coastal and marine information and spatial data in Ireland. MIDA provides an overview of topics related to the Irish coast, as well as an interactive atlas where you can choose layers from various organisations to view and query.

Close

Metadata Viewer - Co... Catalogue - ICAN ICAN - Event Monitor

18:49



Demonstration



ICAN Catalogue



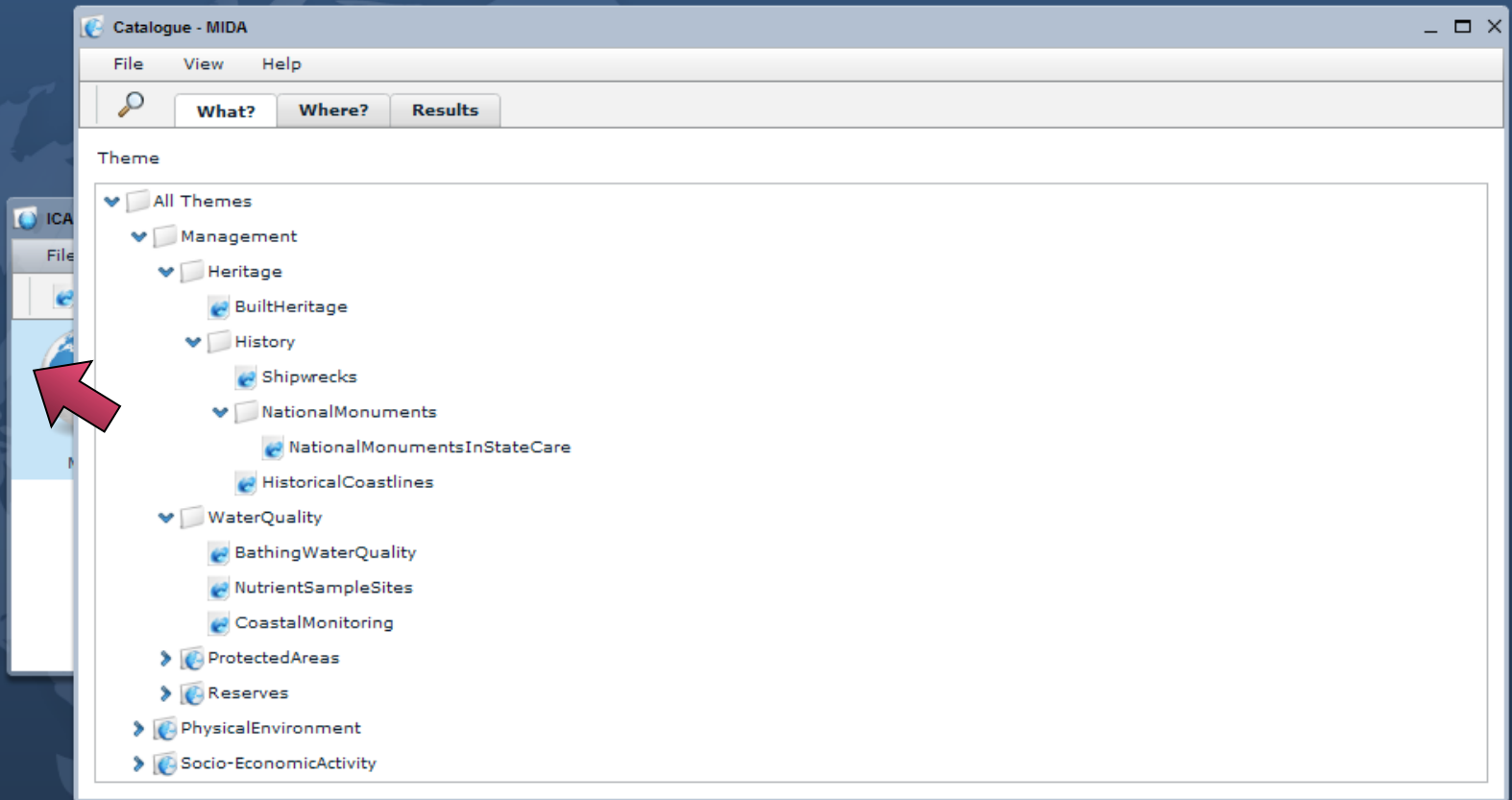
Network



Administration



Event Monitor



International Coastal Atlas Network



Metadata Viewer - Co...



Catalogue - ICAN



ICAN - Event Monitor



Node Properties - MI...

18:51



Demonstration



ICAN Catalogue



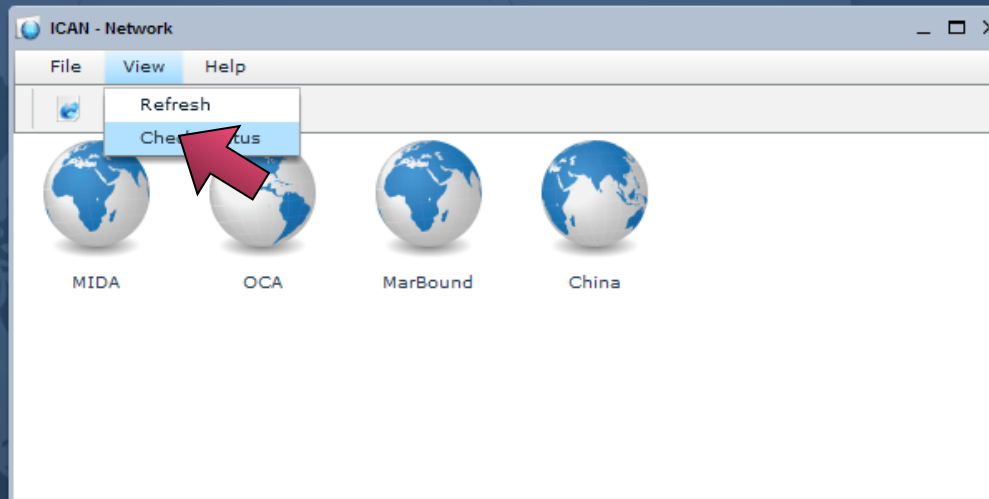
Network



Administration



Event Monitor



Metadata Viewer - Co...

Catalogue - ICAN

ICAN - Event Monitor

Node Properties - MI...

18:52



Demonstration



ICAN Catalogue



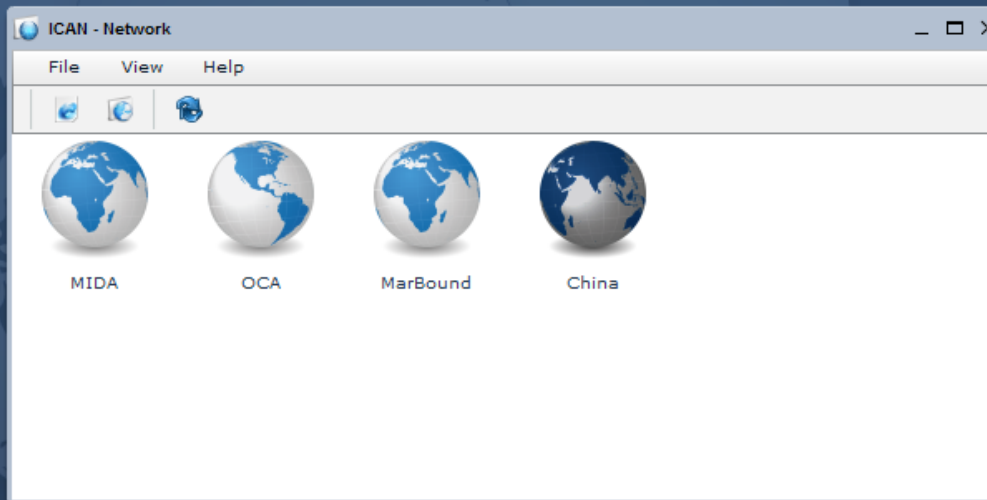
Network



Administration



Event Monitor



Metadata Viewer - Co...



Catalogue - ICAN



ICAN - Event Monitor



Node Properties - MI...

18:53



Demonstration



ICAN Catalogue



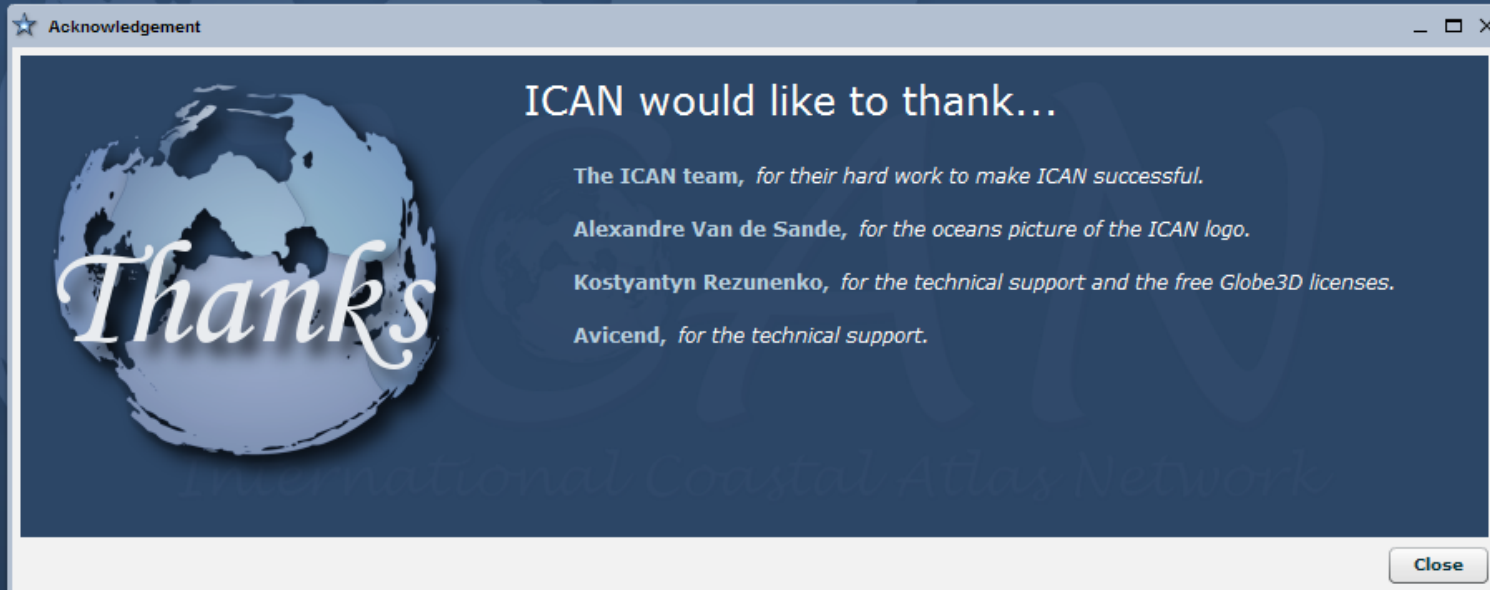
Network



Administration



Event Monitor



Metadata Viewer - Co...

Catalogue - ICAN

ICAN - Event Monitor

Node Properties - MI...

ICAN - Network

18:54



Progress to Date

- Outline
- Problem
- Terminology
- Idea
- Approach
- Architecture
- Ontologies
- Mappings
- Connection
- Query Rewriting
- Demonstration
- Progress to Date
- Conclusion
- Future Work

- Version 1.0 → Version 1.1
- Bugs fixed
 - Bounding boxes, idle nodes, etc.
- Idle nodes
- New GUI using Adobe Flex
- Separation between server side and client side code
- New functionalities
 - Direct interaction with nodes, node selection, event monitor,

Conclusion

- Outline
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- Efficient solution for facilitating syntactic, structural and semantic interoperability
- Ontologies and standards facilitate interoperability
- This is a first step in atlases interoperability focusing only on metadata and catalogue services





Future Work

- Outline
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- Conclusion
- Future Work

- Include Web Map Service (WMS) for data visualisation
- Include Web Feature Service (WFS) & Web Coverage Service (WCS) for actual data delivery
- Share resources (thematic information about layer)
 - Structure thematic information using ontologies (instruments, platforms, parameters, themes, disciplines, etc.)



Future Work

- Outline
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- Future Work

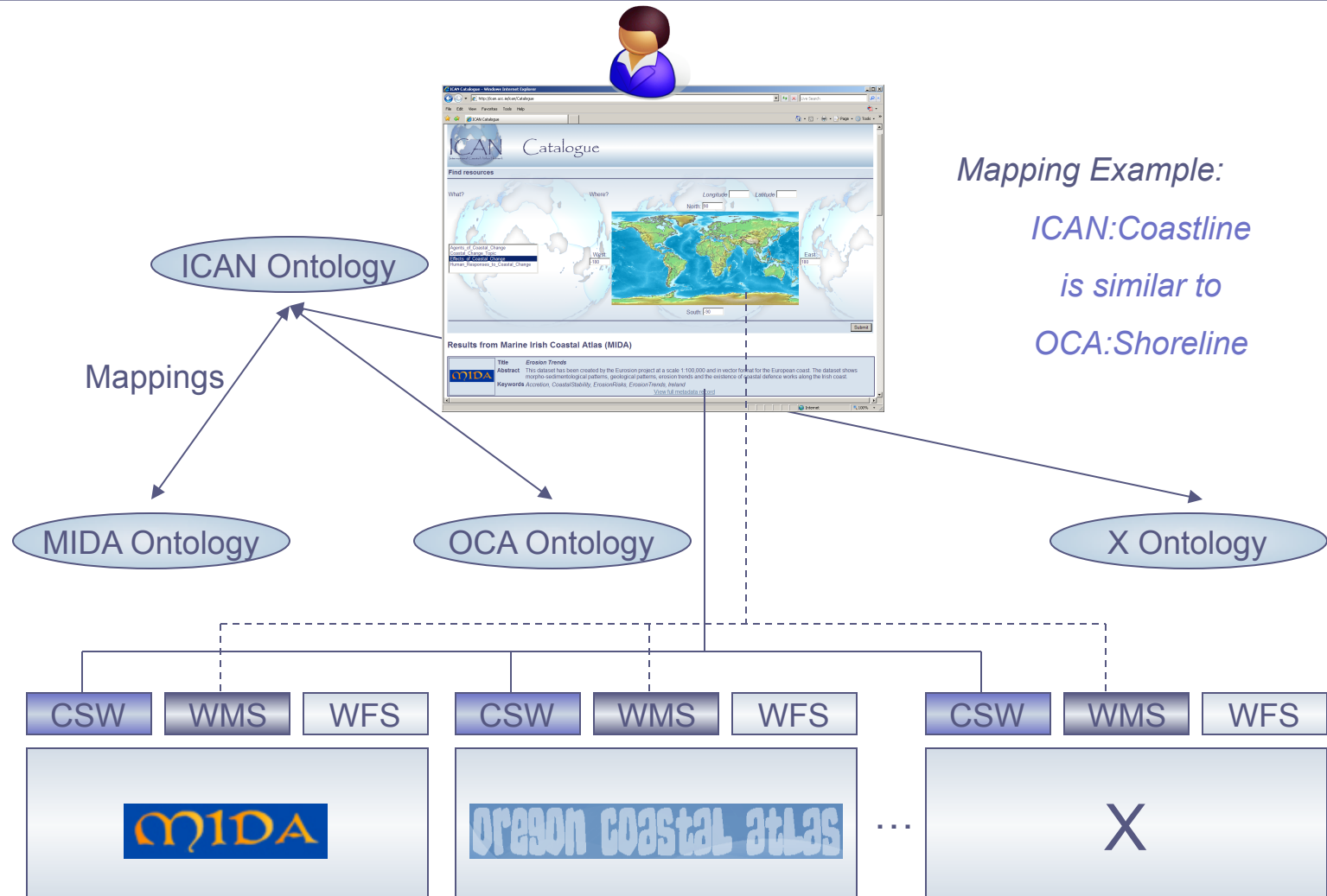
- Advanced semantic framework

Driven by NETMAR

<http://esaotewiki.epistemica.com/OTE/navigateInfoDomain>

Future Work

- Outline
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- Conclusion
- Future Work





Thank You



UCC

Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

Oregon State
UNIVERSITY **OSU**