Project No. 249024

NETMAR

Open service network for marine environmental data

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	Coordinator: Prof. Stein Sandven Nansen Environmental and Remote Sensing Center Thormøhlensgate 47, Bergen, Norway Tel.: +47 55 20 58 00 Fax. +47 55 20 58 01 E-mail: stein.sandven@nersc.no

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Consortium

The NETMAR Consortium is comprised of:

- Nansen Environmental and Remote Sensing Center (NERSC), Norway (coordinator).
  Project Coordinator: Prof. Stein Sandven (stein.sandven@nersc.no)
  Deputy Coordinator: Dr. Torill Hamre (torill.hamre@nersc.no)
  Quality Control Manager: Mr. Lasse H. Pettersson (lasse.pettersson@nersc.no)
- British Oceanographic Data Centre (BODC), National Environment Research Council, United Kingdom
  Contact: Dr. Roy Lowry (rkl@bodc.ac.uk)
- Centre de documentation de recherche et d'expérimentations sur les pollutions accidentelles des eaux (Cedre), France.
  Contact: Mr. François Parthiot (Francois.Parthiot@cedre.fr)
- Coastal and Marine Resources Centre (CMRC), University College Cork, National University of Ireland, Cork, Ireland.
  Contact: Mr. Declan Dunne (d.dunne@ucc.ie)
- Plymouth Marine Laboratory (PML), United Kingdom.
  Contact: Mr. Steve Groom (sbg@pml.ac.uk)
- Institut français de recherche pour l'exploitation de la mer (Ifremer), France.
  Contact: Mr. Mickael Treguer (mickael.treguer@ifremer.fr)
- Norwegian Meteorological Institute (METNO), Norway.
  Contact: Mr. Øystein Torget (oysteint@met.no)

Author(s)

- Torill Hamre, NERSC, (torill.hamre@nersc.no)
- Morten Stette, NERSC, (morten.stette@nersc.no)
- Mickael Treguer, IFREMER, (mickael.treguer@ifremer.fr)
- Yassine Lassoued, CMRC, (Y.Lassoued@ucc.ie)
- Jorge de Jesus, PML, (jmdj@pml.ac.uk)
- Mike Grant, PML (mggr@pml.ac.uk)

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Executive Summary

NETMAR aims to develop a pilot European Marine Information System (EUMIS) for searching, downloading and integrating satellite, in situ and model data from ocean and coastal areas. EUMIS will use a semantic framework coupled with ontologies for identifying and accessing distributed data, such as near-real time, forecast and historical data. The semantic tools have been implemented as portal components (called portlets) and web services. Portlets for retrieval and display of geographic datasets, “smart” search and discovery, and service chain composition have now been developed and integrated in the EUMIS portal. The EUMIS portal also contains a Wiki and a Forum, where users can find information about products and services, and discuss topics of interest related to these, respectively.

The portal wiki and forum provide an overview of the products and services that are offered by EUMIS, and how to use the different tools in the portal. The portal home page offers pointers to these resources, as well as information on selected products and services, relevant news feeds and announcements of workshops and other venues where products and services are presented. All content in the wiki and forum are open to everyone, and both the wiki and forum can be searched by free text search. Users can also register in the portal. This will give them access to more services, and the ability to ask questions in the forum.

The GIS Viewer allows users to display on a map distributed geo-spatial resources that have been shared by means of the OGC Web Map Service (WMS) standard. It provides a user-friendly way of browsing WMS servers to see what features they have available, choosing those of interest, and seeing the resulting map. The GIS viewer allows the user to obtain multiple layers overlaid on top of one another in the same geographic map projection. If the WMS server supports it, a user can click on a feature to get additional information about it, such as the values measured by an in situ sensor. Layers can be added and removed dynamically, and their display easily turned on and off. The GIS map viewer also includes common GIS functions (e.g. zoom, pan, legends), shows the latitude-longitude location of the cursor inside a map, and facilitates printing of the currently displayed layers.

Smart search is the ability of a discovery engine to locate target documents that do not include either an exact or fuzzy match to a user-supplied text string or user-supplied keyword. For example, if the user initiates a search on the discipline keyword ‘Physical Oceanography’, the discovery engine find documents marked up with terms like ‘currents’, ‘waves’, ‘water temperature’, ‘salinity’ and so on, because these are semantically linked to the search criteria. The smart search and discovery client supports three features: ontology browsing, dataset smart search, and metadata visualisation. It provides search facilities based on the *semantics* of the data, including support for multi-domain and multi-lingual search in a network of metadata catalogue services connected by a mediator tool.

The service chaining editor allows users to generate new products by specifying workflows that utilise a set of data delivery and processing services. The workflow is generated using a graphical editor where individual services are chained together to form a new process. The workflows can be saved for later use, re-opened and edited, and exported to a workflow engine like Taverna for execution and display of the resulting product.

All components are realised as portlets that are deployed in the open source Liferay Community Edition portal. The portlets will run in any commonly used web browser; no additional plugins are needed.

The EUMIS portal is publicly available at http://eumis.nersc.no/.

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1 Introduction

1.1 Background

NETMAR aims to develop a pilot European Marine Information System (EUMIS) for searching, downloading and integrating satellite, in situ and model data from ocean and coastal areas. EUMIS will use a semantic framework coupled with ontologies for identifying and accessing distributed data, such as near-real time, forecast and historical data. The semantic tools have been implemented as portal components (called portlets) and web services. Portlets for retrieval and display of geographic datasets, "smart" search and discovery, and service chain composition have now been developed and integrated in the EUMIS portal.

The EUMIS portal also contains a Wiki and a Forum, where users can find information about products and services, and discuss topics of interest related to these, respectively. These components are realised using built-in portlets in the Liferay Community Edition [LRv6], and for user registration and setting permissions we also use the built-in features of Liferay.

1.2 Objective of this report

The purpose of this document is to describe the functionality of the EUMIS portal and the three EUMIS components that have been integrated: (1) the GIS map-viewer (WP6), (2) the semantic search and discovery client (WP4), and (3) the service chaining editor (WP6). This first version of the EUMIS portal with these components integrated will be used to demonstrate proof-of-concept of the semantic tools and the portal during autumn 2011 in interaction with user trials (WP1).

1.3 Terminology

A **concept URI** is a pre-defined URI uniquely identifying a term (i.e. concept) in a vocabulary (i.e. controlled list of terms) for a given application domain. For example, the concept URI http://vocab.ndg.nerc.ac.uk/term/P011/current/ATEMP2MM identifies the term "Temperature (2m) of the atmosphere by model prediction" in the BODC Parameter Usage Vocabulary P011.

A **portal** is a web site that collects input from a number of sources, and presents it in a uniform manner to the user. The portal content is perceived to come from the same source – the portal – while it typically is a combination of content from several sources, or an extract of selected content from a single external source (such as a news feed).

A **portlet** is portal component that can be deployed in a portal. A portlet can provide many types of functionality, among others, retrieve data from external sources, process and analyse data, present retrieved data on a geographic map. A portlet can also communicate with other portlets running in the same portal.

A **Uniform Resource Identifier (URI)** is "a compact string of characters for identifying an abstract or physical resource" [RFC2396]. A URI can among others identify a file or a part of an online document, which can be identified by e.g. ftp://ftp.is.co.za/rfc/rfc1808.txt or http://www.w3.org/TR/2009/REC-skos-reference-20090818/#concepts.

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1.4 Organisation of this report

The remainder of this report is organised as follows. Section 2 describes the content and features of the wiki and forum of the EUMIS portal. These provide information about the products and services offered, and allow registered users to ask for more information by asking questions to the EUMIS developers and service providers in the forum. Section 3-5 then goes on to explain the features of and how to use the three EUMIS components, the GIS viewer (section 3), the discovery and search client (section 4) and the service chaining editor (section 5). Finally, the features of the first version of the EUMIS portal is summarised in section 6.

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2 Wiki and forum

The portal wiki and forum provide an overview of what products and services are offered by the EUMIS, and how to use the different tools in the portal. The home page of the portal offers pointers to these resources, as well as providing information of selected products and services, relevant news feeds and announcements of workshops and other venues where products and services are presented (Figure 2-1).

The portal home page also offers users the possibility to register, using the “Sign In” portlet in the left column of Figure 2-1. While most products and services are public, a few requires registration (e.g. to run forecasting models). Also, only registered users are allowed to post questions in the forum. This is to avoid spam. The user registration process is simple, and requires filling in a valid e-mail address, first name, last name, screen name and a question to be used if the user forgets his/her password (Figure 2-2). To verify that the request for a user account is not coming from a computer, it is also necessary to fill in a verification field with four digits from an image generated by the Liferay portal. Optionally, the user’s birth date and gender can also be filled in. Once registered, the user can log in using his/her e-mail as account name and with the chosen password.

From the home page, the user can navigate to the wiki, forum or pilots using the main menu shown near the top of the page, or by using the site map (“Site Map” portlet in the left column of Figure 2-1). The user can also search the entire portal from the home page.

Figure 2-1 EUMIS portal home page.

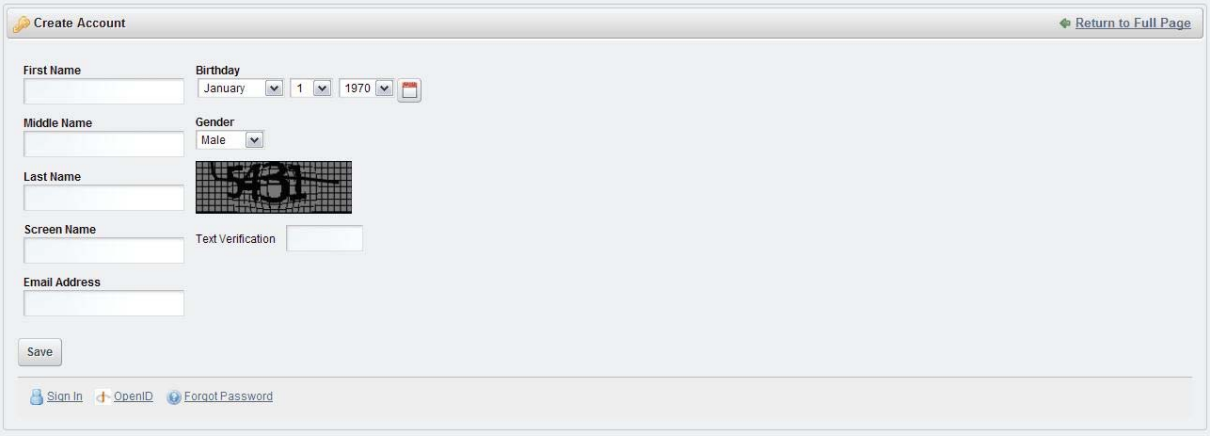

Figure 2-2 User registration in the EUMIS portal.

2.1 Wiki content and organisation

The EUMIS wiki homepage gives a brief overview of the topics covered, with links to separate pages (Figure 2-3). Currently, there are wiki sections for each of the pilots, as well as for the technologies and tools used to develop the services and for the metadata provided for each product. The wiki can also be searched by giving a free text in the text area near the top of the page. When searching for e.g. “sea ice” the portal will return a list of all wiki pages containing this string with the most relevant pages first, as illustrated in Figure 2-4. Each page name is a link that can be clicked on to go directly to it.

Each pilot wiki has the same overall structure. In the top level page, the pilot wikis contain a short description of: (1) users, (2) products with a few examples, and (3) links to the services offered. Additional sections can be added to each pilot wiki as needed. All pilots may not need the same information and the pilot wiki is open for service providers to add new sections or children pages to fulfil their users’ needs.

Figure 2-5 shows the current pilot 1 wiki. It contains a short description of targeted users, examples of products offered and a link to the pilot page where the latest products will be available. As the amount of information grows, the Table of Contents feature at the top of the page provides handy help to go quickly to the information of interest. Further information can also be placed in separate pages, so-called children pages, to avoid the main page to become unmanageable.

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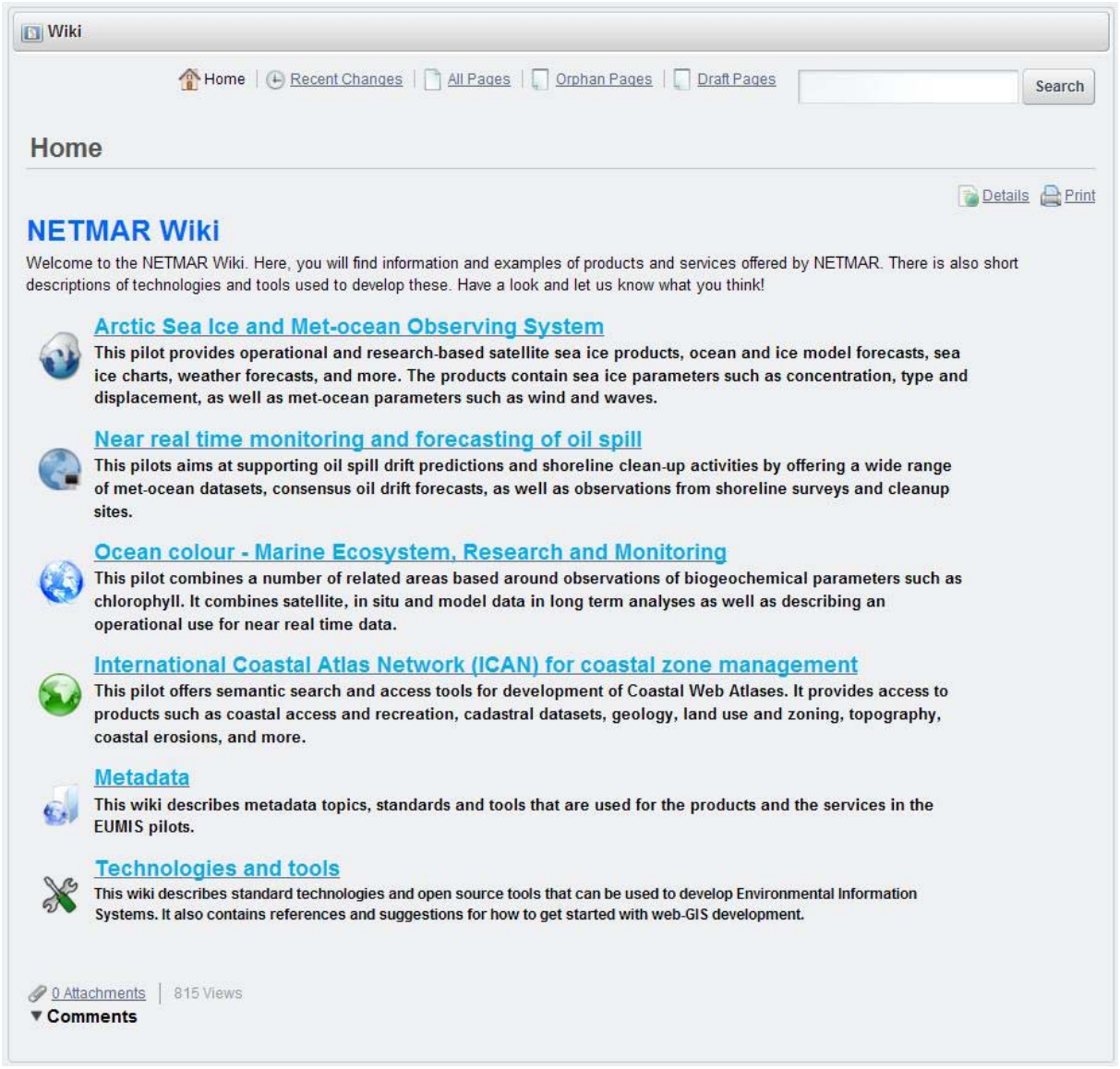

Figure 2-3 EUMIS Wiki home page.

Figure 2-4 Example of search result in the EUMIS wiki.

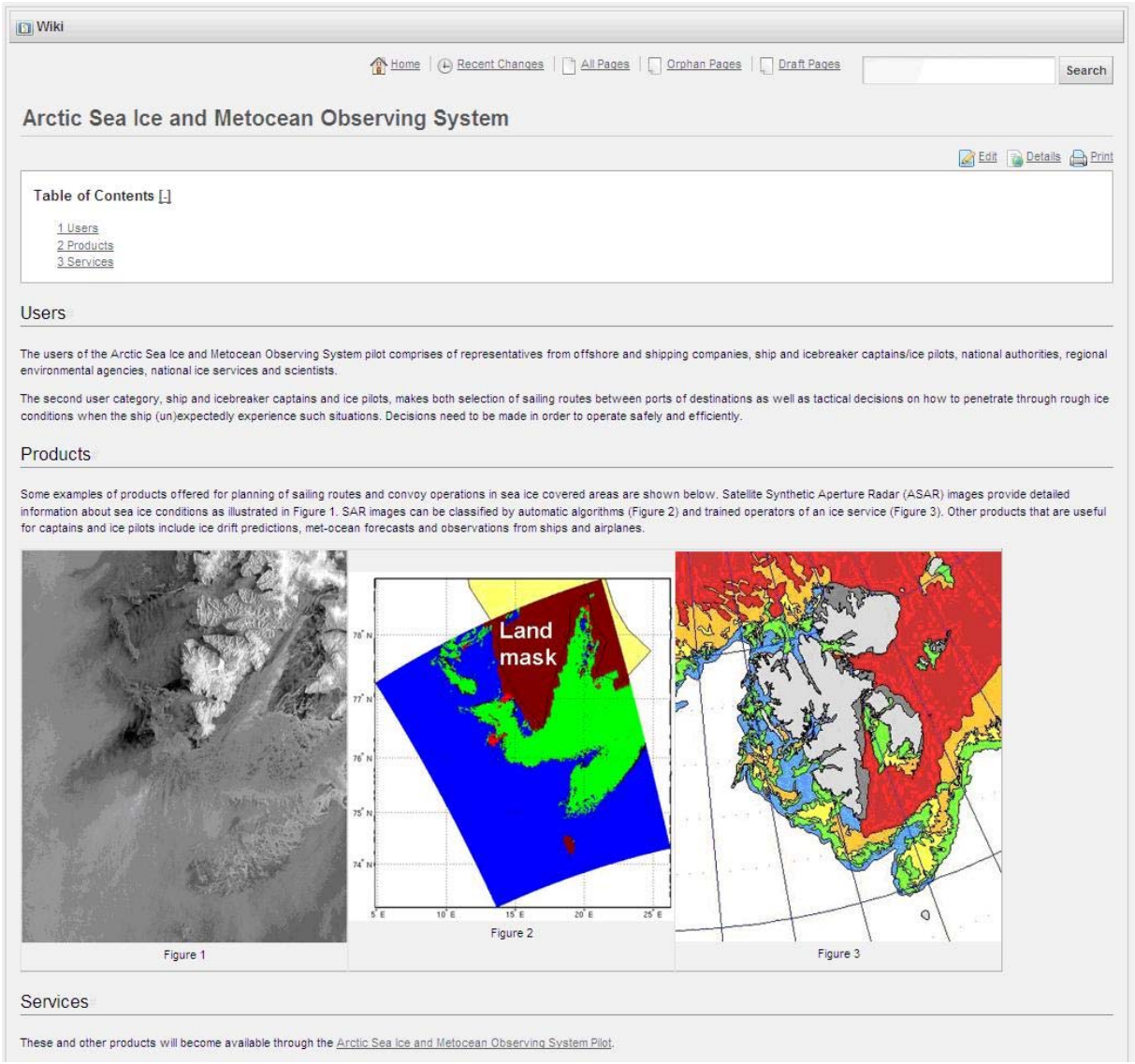

Figure 2-5 EUMIS portal: Pilot 1 Wiki homepage.

2.2 Forum categories and threads

The forum enables users to ask questions to the EUMIS developers and service providers, about the tools, products and services offered by the portal. A series of related questions are grouped in *categories*, and each question with corresponding answers (as well as follow-up questions and their answers) are placed in a *thread*. Currently, there are three predefined categories:

1. Frequently Asked Questions (FAQ)
2. Products and Services
3. Technologies

but more categories can easily be added, as needed.

On the forum home page all categories are listed alphabetically (Figure 2-6), and within each category, the threads (i.e. questions and their answers) are ordered chronologically. Clicking on the category name opens a new window with all threads in that category (Figure 2-7). Clicking on any of the threads opens it for reading (Figure 2-8), and registered users can post follow-up questions. It is also possible to subscribe to an RSS feed from a forum thread.

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Registered users can also create new threads with new questions. Before posting, however, one should always check if the same or a similar question has been posted earlier. The search facility, which is located near the top of all forum windows, can be used for this purpose. Searching can also be used within a thread.

Figure 2-6 EUMIS forum home page.

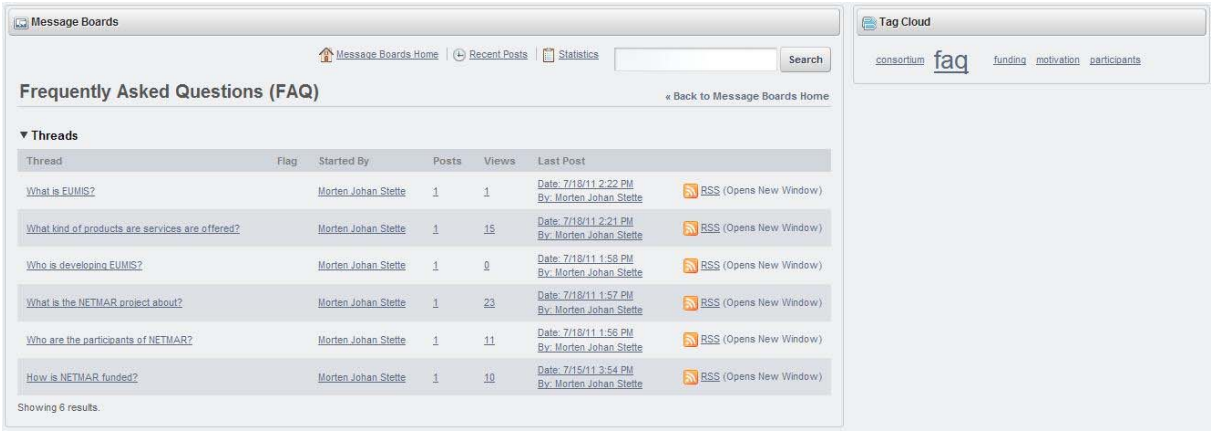

Figure 2-7 EUMIS forum threads in the FAQ (Frequently Asked Questions) category.

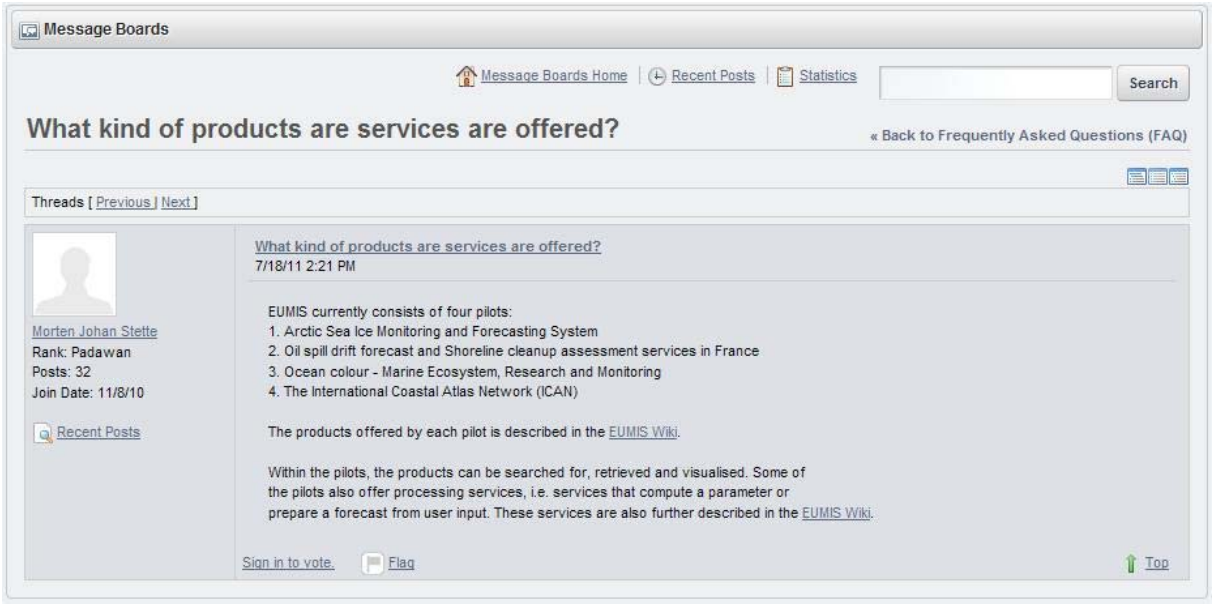

Figure 2-8 Example of a thread in the EUMIS forum.

3 GIS map viewer

3.1 Purpose and features

The GIS Viewer allows users to display on a map distributed geo-spatial resources that have been shared by means of the OGC WMS standard [WMS13]. It provides a user-friendly way of browsing WMS servers to see what features they have available, choosing those of interest, and seeing the resulting map. The GIS viewer allows the user to obtain multiple layers overlaid on top of one another in the same geographic map projection. If the WMS server supports it, a user can click on a feature to get additional information about it, such as the values measured by an in situ sensor.

The GIS Viewer allows users to visualise a large number of cartographic layers obtained from a network of WMS services. These services are provided by various software tools, such as MapServer [MS], Geoserver [GS], Constellation-SDI [CSDI] and ncWMS [NCW]. Layers can be added and removed dynamically, and their display easily turned on and off. The GIS map viewer also includes common GIS functions (e.g. zoom, pan, legends), with the addition of its capacity to interrogate multi-dimensional services, e.g. time and elevation. The location of the cursor inside a map is shown below the map, and the currently displayed layers can be printed from the GIS Viewer.

The first version of the GIS Viewer supports two map projections: (1) the latitude-longitude projection, and (2) polar stereographic map projection. Later version of the viewer may support additional projections, depending on user needs.

3.2 How to use it

When started for the first time, the GIS Viewer will show a coastline layer (Figure 3-1). All functions are readily available in a toolbar above the map area, and the position of the cursor (crosshair) in the map and the map scale is shown below. To the left, all current layers are listed, with operations for turning them on/off and manipulating the colours used when displaying them.

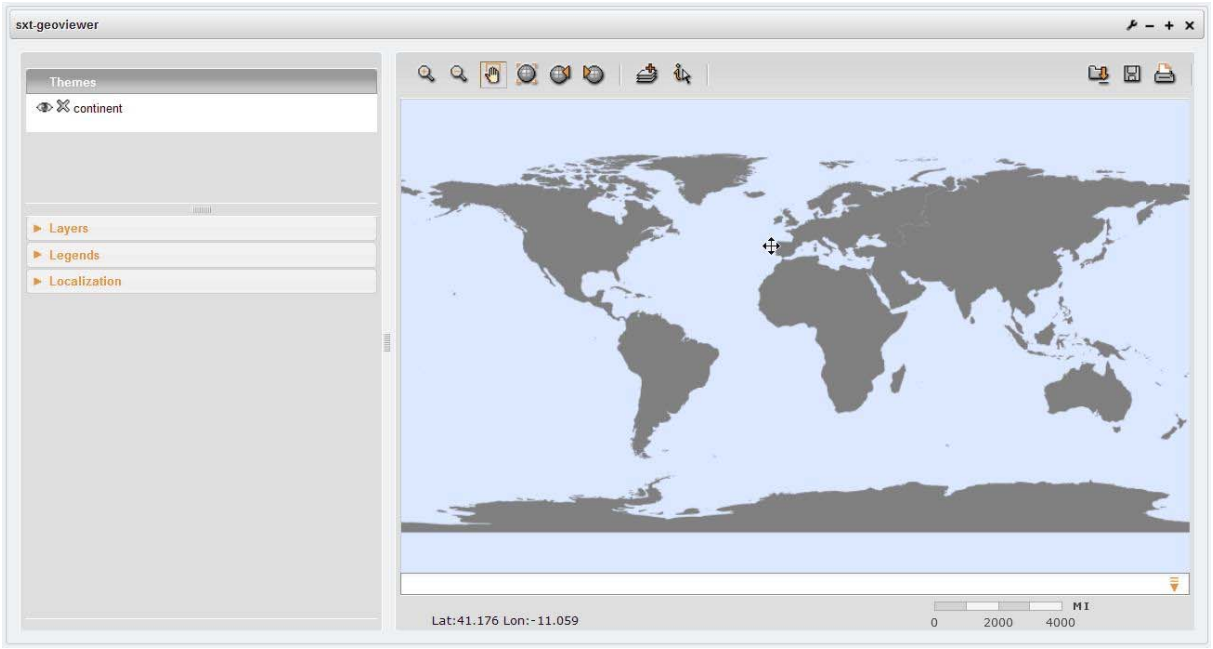

Figure 3-1 GIS Viewer: Initial map with coastline.

All buttons in the toolbar have a so-called *tooltip*, a short text explaining what function they perform. The tooltip is shown when placing the cursor over the button and resting it there for a few seconds (Figure 3-2). The three first buttons on the toolbar provide zoom in, zoom out and pan operations on the map. The three next buttons restore the map to the original extent, go back to previous zoom and go to the next zoom, respectively. The next button, , allows the user to add more WMS layers to the map, while the button allows the user to query a feature in the map. The last three buttons on the toolbar, uploads an OWS context file (holding a predefined set of WMS map layers), saves such a file, and prints the currently displayed map, respectively.

After clicking the add WMS layer button, , a dialogue box opens where the user can enter a WMS server URL, as shown in Figure 3-3 . The GIS viewer obtains a list of layers available from this WMS server, and the user can then select which to add to the map. The selected layers are added to the layer list, and displayed in the map window (Figure 3-4).

Each layer can then be manipulated using the layer menus in the left part of the screen. For instance, it is possible to zoom to the extent of a layer to focus the map (Figure 3-5). Layers can be turned on/off by clicking the eye-symbol ( ) in front on the layer name, and be removed permanently be pressing the delete button ( ). To re-insert a layer, just open the add layer dialogue again, give the WMS server URL and select it again.

Figure 3-2 GIS Viewer: Tooltips for the toolbar buttons.

Figure 3-3 GIS Viewer: Adding more WMS layers.

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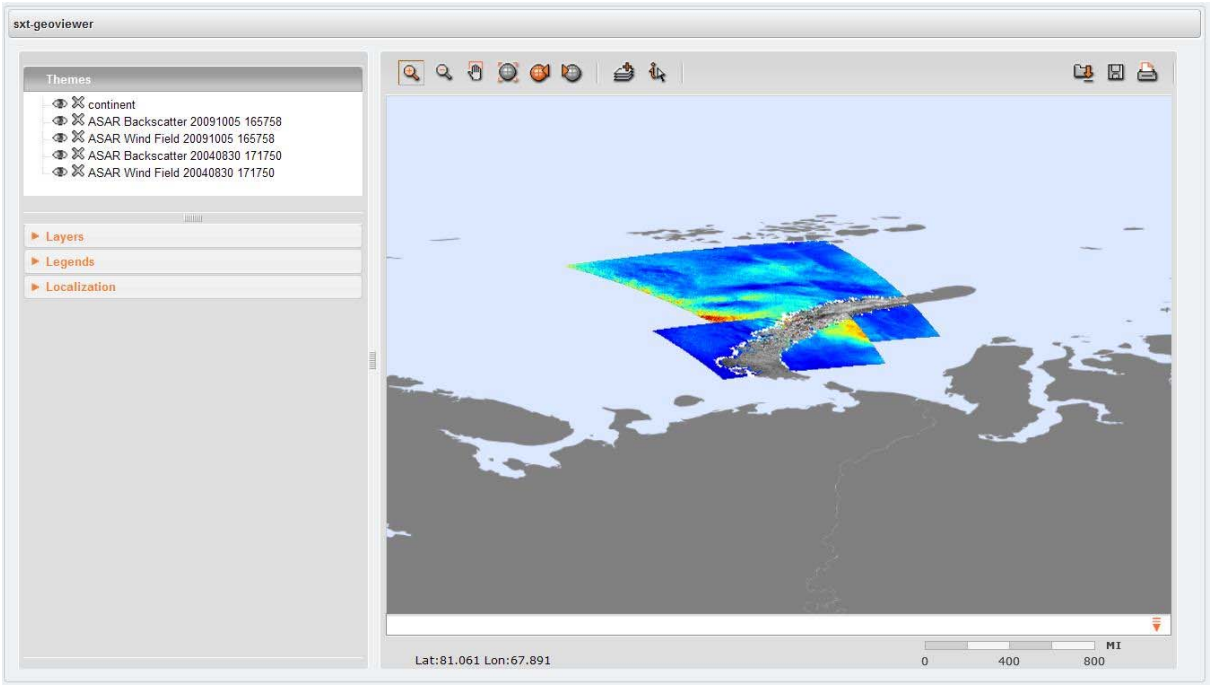

Figure 3-4 GIS Viewer: New layers added to the map.

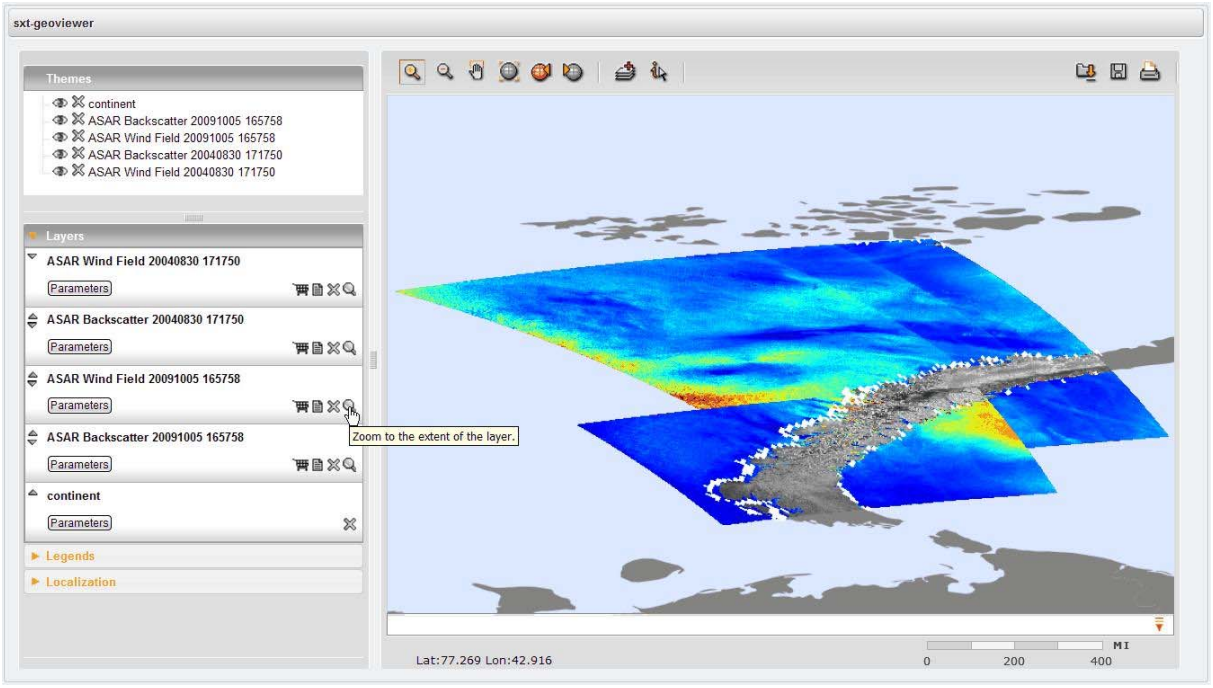

Figure 3-5 GIS Viewer: Zoom to the extent of a layer.

3.3 Implementation

The GIS Viewer is implemented using the MapFaces library [MF]. MapFaces has a modular design consisting separate Java Server Faces (JSF) components resting on a base geo-spatial library. The components rely on several JavaScript elements for user interface elements running in the browser on the client side. Mapfaces uses the jQuery JavaScript library to provide elegant and powerful components in a compact, highly structured library [JQ]. MapFaces also uses a simplified version of the OpenLayers JavaScript library for

displaying map data in web browsers, providing functionality like transparent layers and simple navigation panel [OL].

The GIS viewer is a portlet running inside the Liferay Community Edition (version 6.0.5) portal [LRv6]. It uses two Java libraries:

- Java Advanced Imaging (JAI) 1.1.3 [JAI].
- Java Advanced Imaging I/O (JAI Image-I/O) libraries Image I/O 1.1 [JAIIO].

These must be installed on the portal server before the portlet itself is installed.

Figure 3-6 shows a simple architecture diagram for the GIS Viewer. The client side is realised by mean of two open source libraries, OpenLayers [OL] for all GIS operations (e.g. map display, zooming and panning) and jQuery [JQ] for setting up the layer lists and panels for legends etc., in the graphical user interface (GUI). The server side is comprised of components from the MapFaces library and the GeoToolkit library [GT]. The client and server communicate via the JSF protocol.

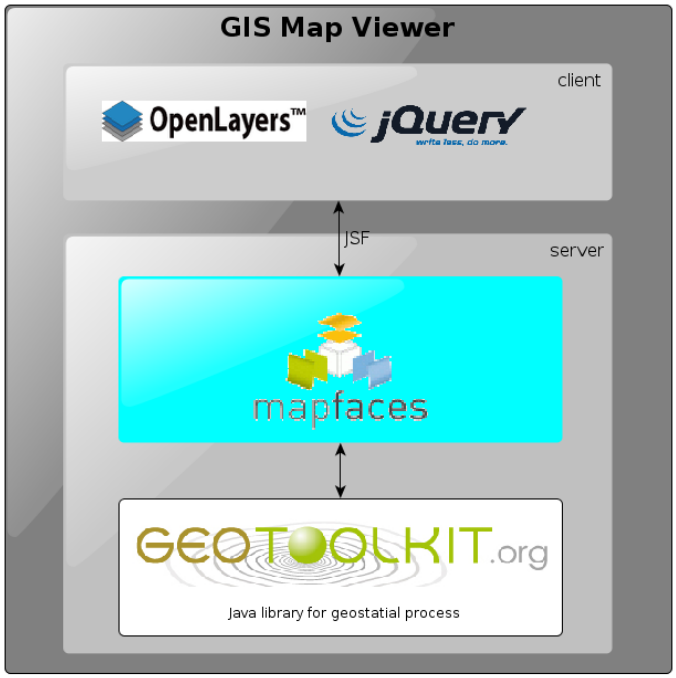

Figure 3-6 GIS Viewer: Architecture diagram.

The GIW Viewer can store the current configuration of map layers for later use. This is done in an XML (eXtensible Mark-up Language) file. There is also a default map context stored in the portlet, at ${TOMCAT_WEBAPPS}sxt-geoviewer-1.0-SNAPSHOT/data/demis.xml.

After adding the layers of interest to the GIS Viewer, each user can store a new map context file for his session. One example is found at:
http://nport.nersc.no:8080/test-area?url=http://www.ifremer.fr/isi/sextant/OWC/netmar.xml

This file contains an example of a set of layers used in NETMAR for monitoring of Phytoplankton blooms in Gulf of Biscay and English Channel. Once loaded into the GIS Viewer, the layer list will look like in Figure 3-7.

The map configuration is stored in OWS-Context files [WMC05]. The example web map context file at http://www.ifremer.fr/isi/sextant/OWC/netmar.xml is shown in Figure 3-8.

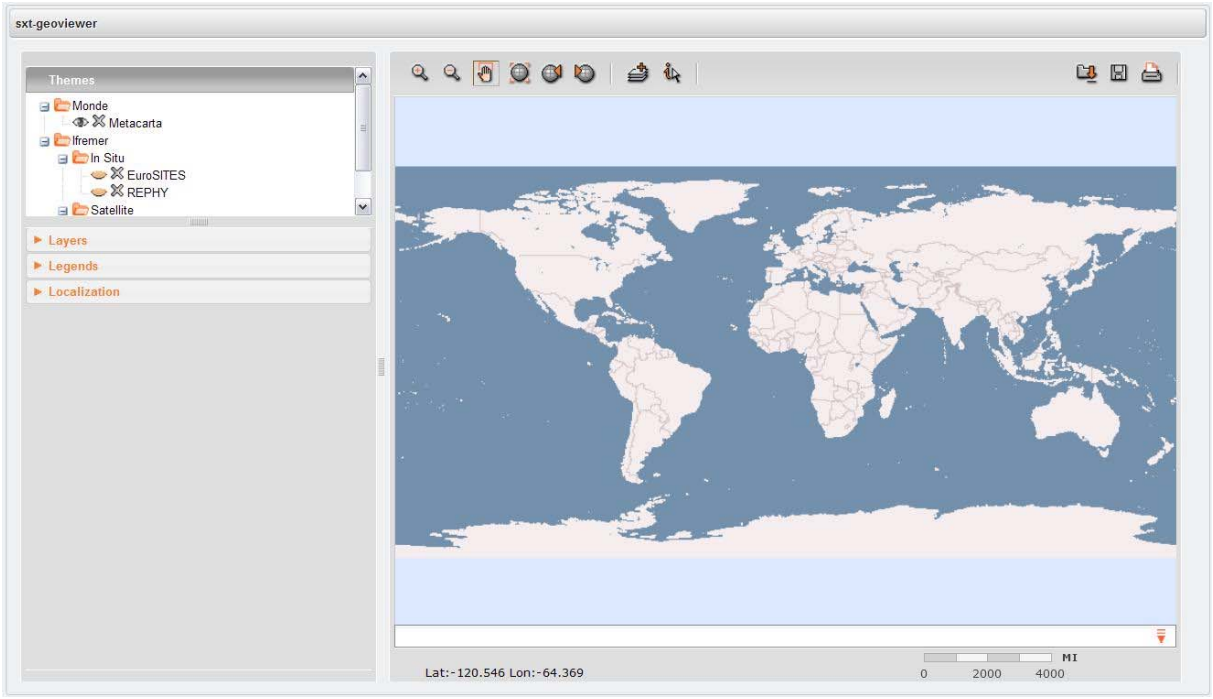

Figure 3-7 GIS Viewer: Loading a predefined set of map layers into the map viewer.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ows-context:OWSContext …>
    <ows-context:General>
        <ows-context:Window height="672" width="1240"/>
        <ows:BoundingBox crs="EPSG:4326">
            <ows:LowerCorner>-90.0 -180.0</ows:LowerCorner>
            <ows:UpperCorner>90.0 180.0</ows:UpperCorner>
        </ows:BoundingBox>
        <ows:Title>BlueMarble + Google (EPSG:3857) example </ows:Title>
        <ows:Abstract/>
    </ows-context:General>
    <ows-context:ResourceList>

        <ows-context:Layer queryable="true" opacity="1" hidden="false" group="Monde"
id="8" name="basic">
            <ows:Title>Metacarta</ows:Title>
            <ows:OutputFormat>image/png</ows:OutputFormat>
            <ows-context:Server   version="1.1.1"   service="urn:ogc:serviceType:WMS"
default="true">
                <ows-context:OnlineResource
xlink:href="http://vmap0.tiles.osgeo.org/wms/vmap0"/>
            </ows-context:Server>
        </ows-context:Layer>

        <ows-context:Layer      queryable="true"      opacity="1"      hidden="true"
group="Ifremer/In Situ" id="5" name="EuroSITES">
            <ows:Title>EuroSITES</ows:Title>
            <ows:OutputFormat>image/png</ows:OutputFormat>
            <ows-context:Server   version="1.3.0"   service="urn:ogc:serviceType:WMS"
default="true">
                <ows-context:OnlineResource
xlink:href="http://www.ifremer.fr/services/wms/swe"/>
            </ows-context:Server>
        </ows-context:Layer>
…

    </ows-context:ResourceList>
</ows-context:OWSContext>
```

Figure 3-8 GIS Viewer: Excerpts of an OWS Context file.

4 Semantic search and discovery client

4.1 Purpose and features

Smart search is the ability of a discovery engine to locate target documents that do not include either an exact or fuzzy match to a user-supplied text string or user-supplied keyword. For example, if the user initiates a search on the discipline keyword 'Physical Oceanography', the discovery engine find documents marked up with terms like 'currents', 'waves', 'water temperature', 'salinity' and so on, because these are semantically linked to the search criteria.

The smart search and discovery client allows users to search for data by *meaning* rather than by mere textual keywords. The first version of this client supports three features: ontology browsing, dataset smart search, and metadata visualisation. It provides search facilities based on the *semantics* of the data, including support for multi-domain and multi-lingual search in a network of metadata catalogue services connected by a mediator tool.

4.2 How to use it

The search and discovery client helps the user find relevant datasets by allowing him to browse the ontology terms to find suitable search criteria. Figure 4-1 shows the client with the two applications, the ontology browser and the search client, to the left, and the start-up screen of the ontology browser in the main window. The ontology browser lists the defined themes, and by clicking on any one of them, their definition is shown along with related terms to the right (Figure 4-2). From here, the user can inspect any of the related terms by clicking on them, or move on to searching by entering a keyword in the search field. Entering e.g. "temperature" will search the ontology for any semantically related terms, and display these with definitions inside the browser (Figure 4-3). Selecting any of the found terms, e.g. "Ocean Temperature" will show the definition of this terms, and its relations (Figure 4-4).

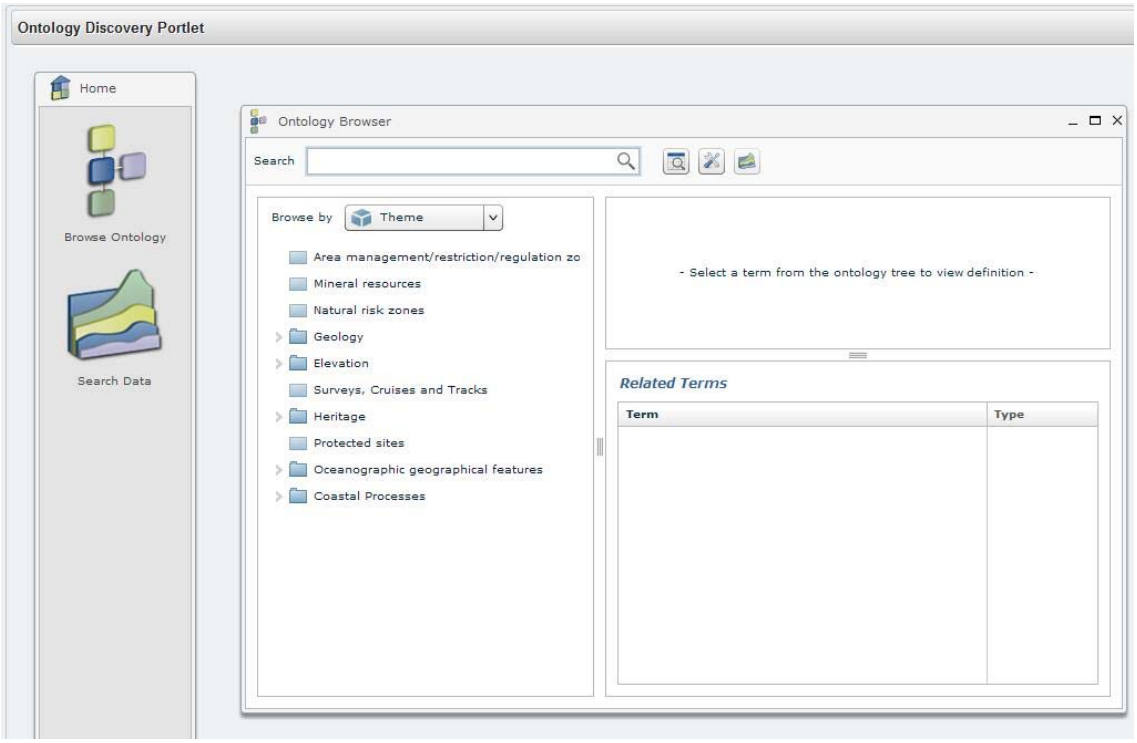

Figure 4-1 Search and discovery client: Startup screen of the ontology browser.

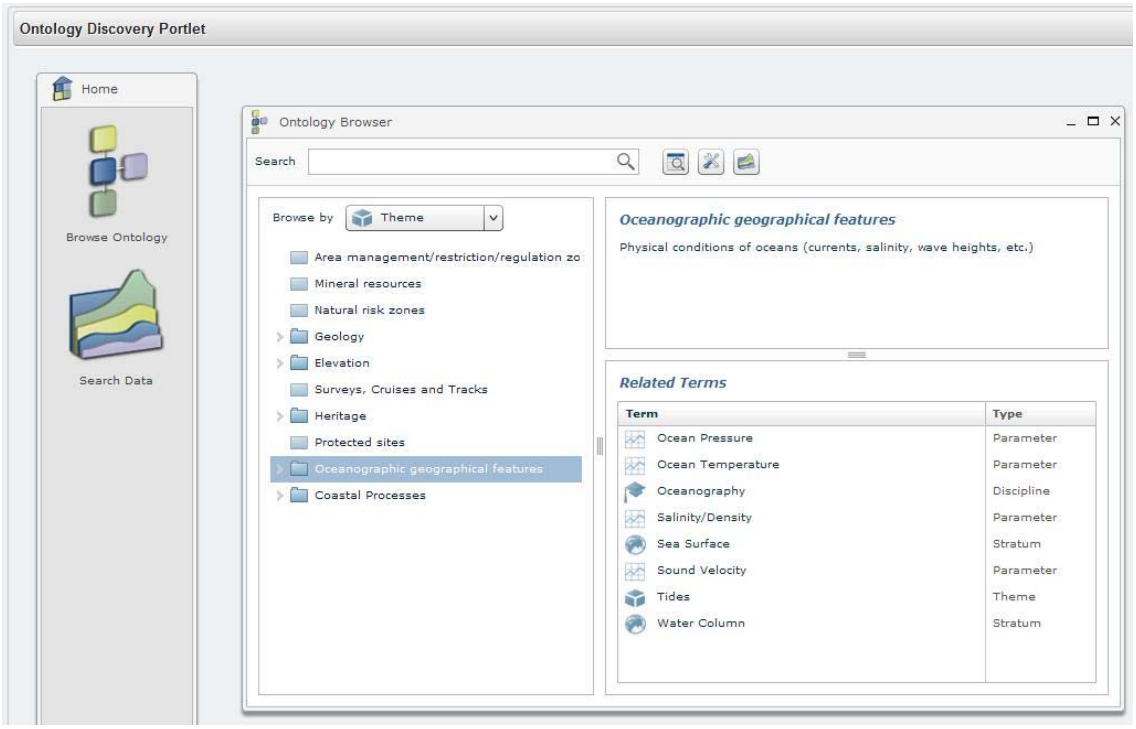

Figure 4-2 Ontology browser: Definition of the chosen term and its related concepts.

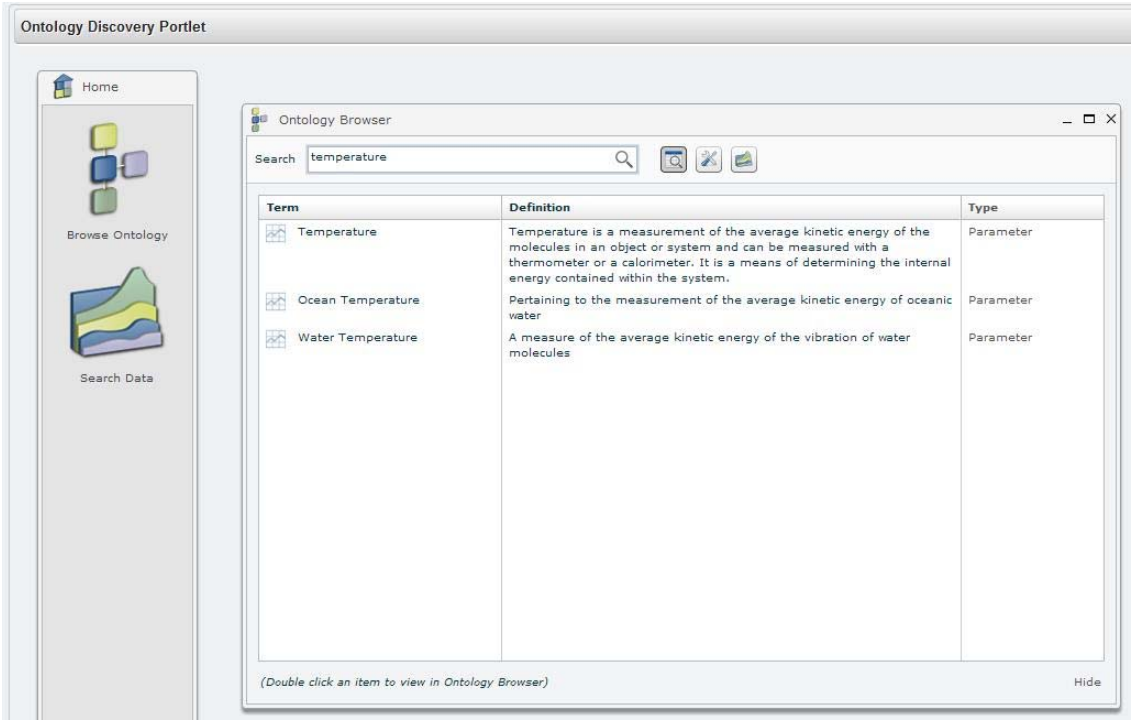

Figure 4-3 Ontology browser: Searching in the ontologies.

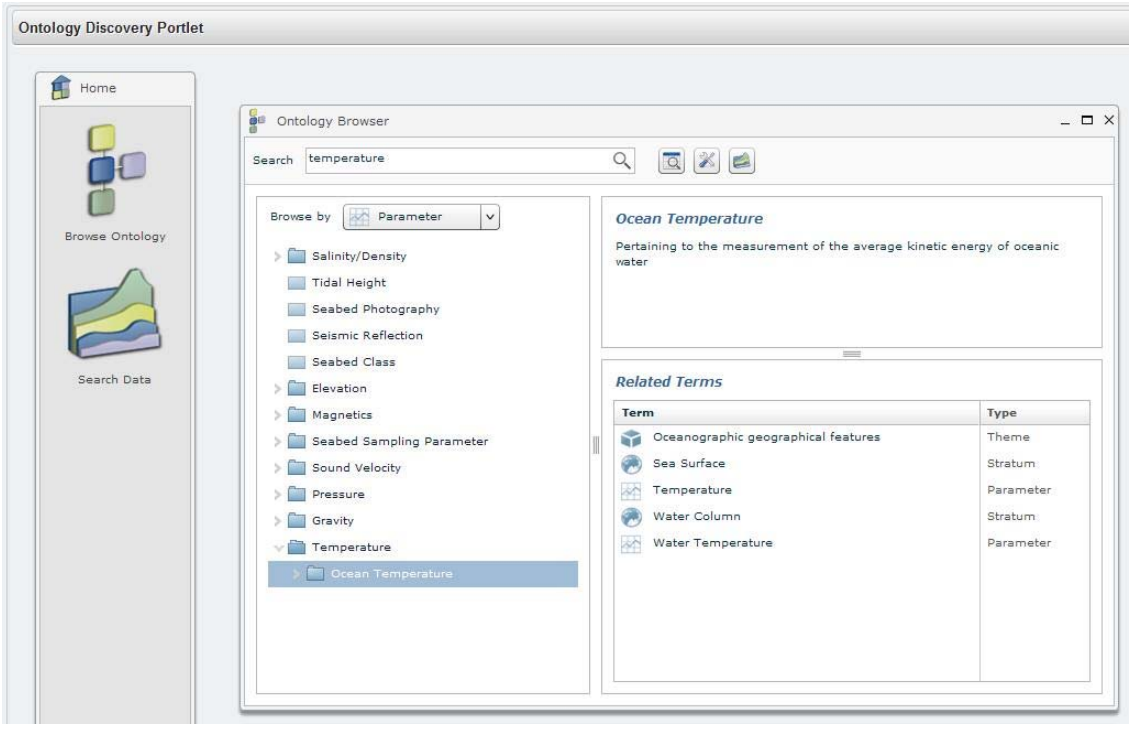

Figure 4-4 Ontology browser: Definition of a discovered term and its relationships.

When a user has found a suitable search term, he can enter it in the search field at the top of the Ontology Browser window, and press the Search Data button (Figure 4-5). This will start the smart search application, called Geo Finder, where the user can select the geographic area of interest before starting the search (Figure 4-6). The search client will present a summary of all datasets matching the criteria (Figure 4-7) and the user can then click on any of the found datasets to get a full metadata listing for it (Figure 4-8).

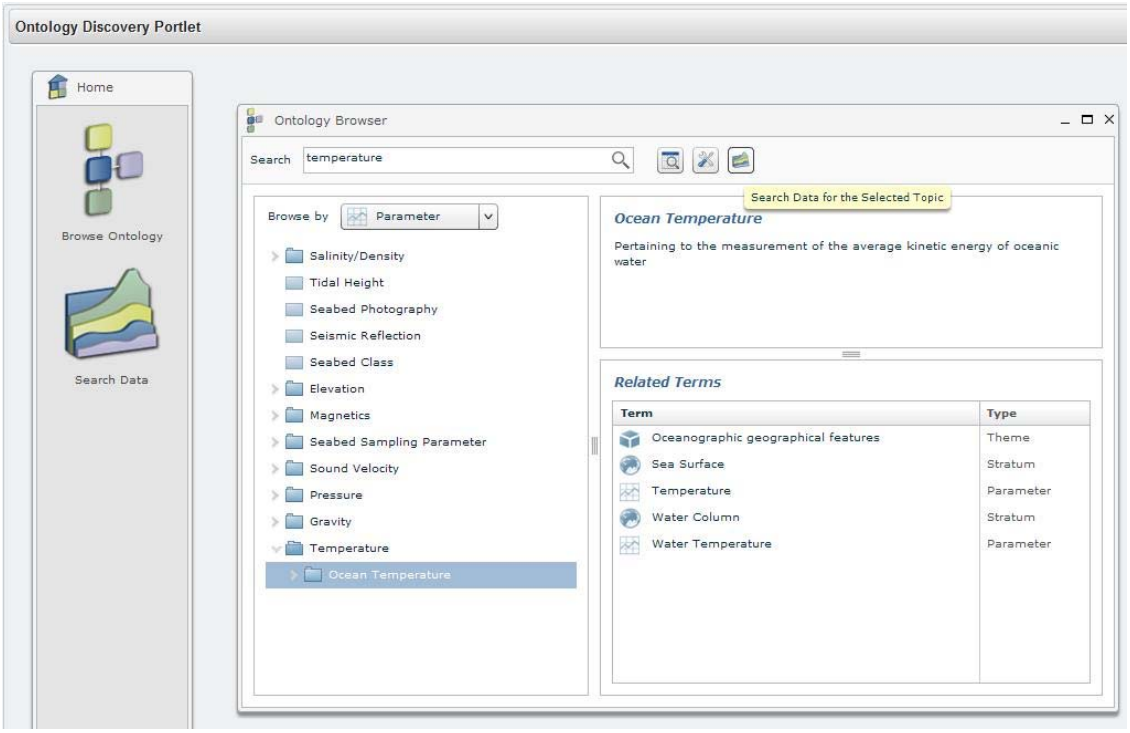

Figure 4-5 Ontology browser: Smart search for data using the term “temperature”.

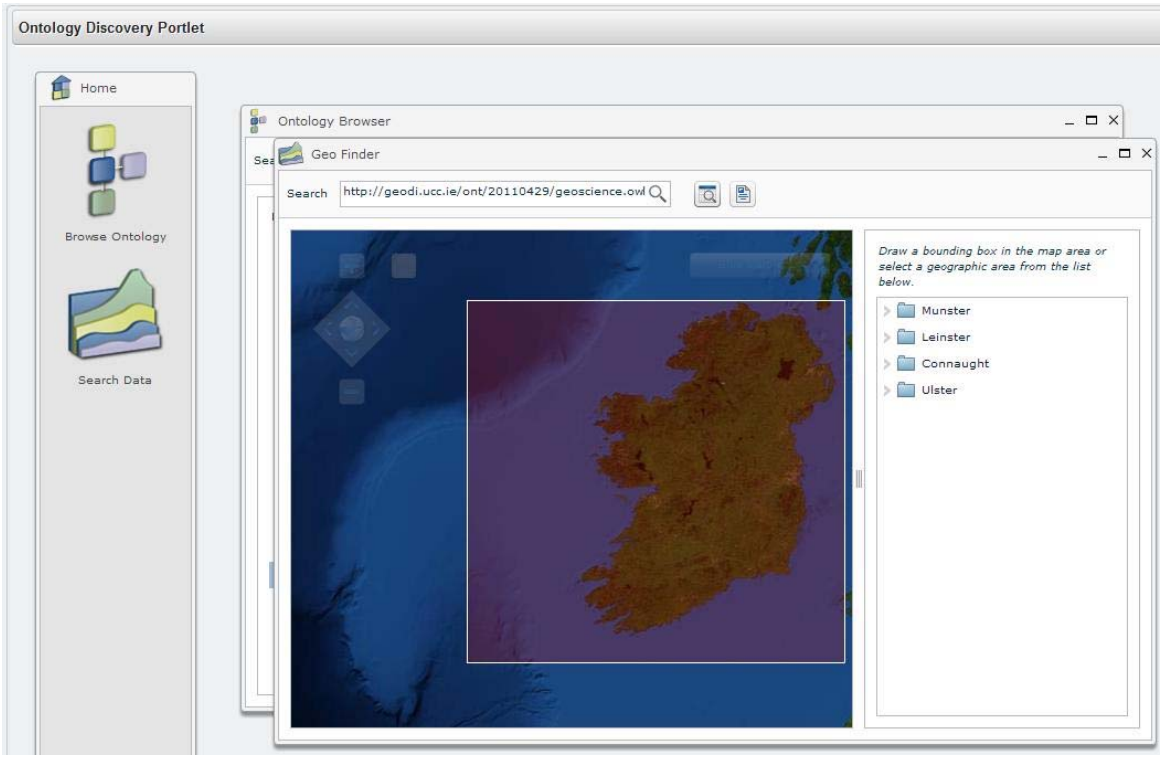

Figure 4-6 Ontology browser: Selecting an area of interest for smart search.

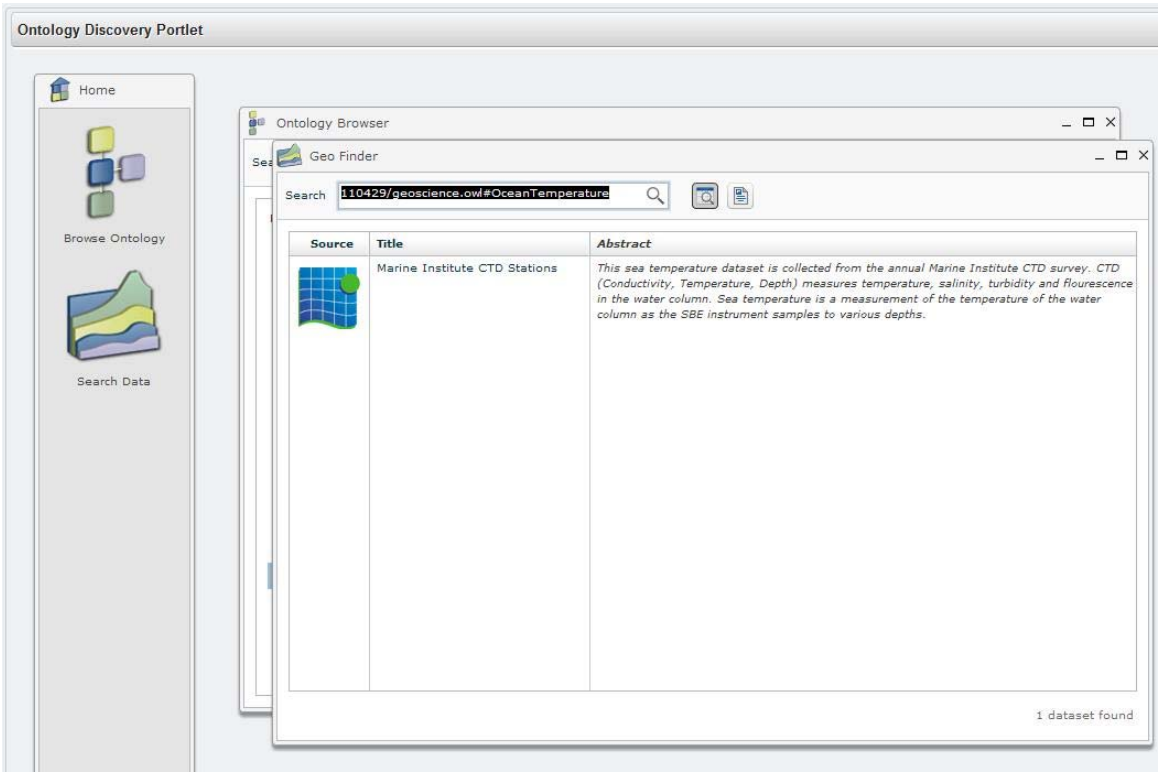

Figure 4-7 Ontology browser: Inspecting the results of a smart search.

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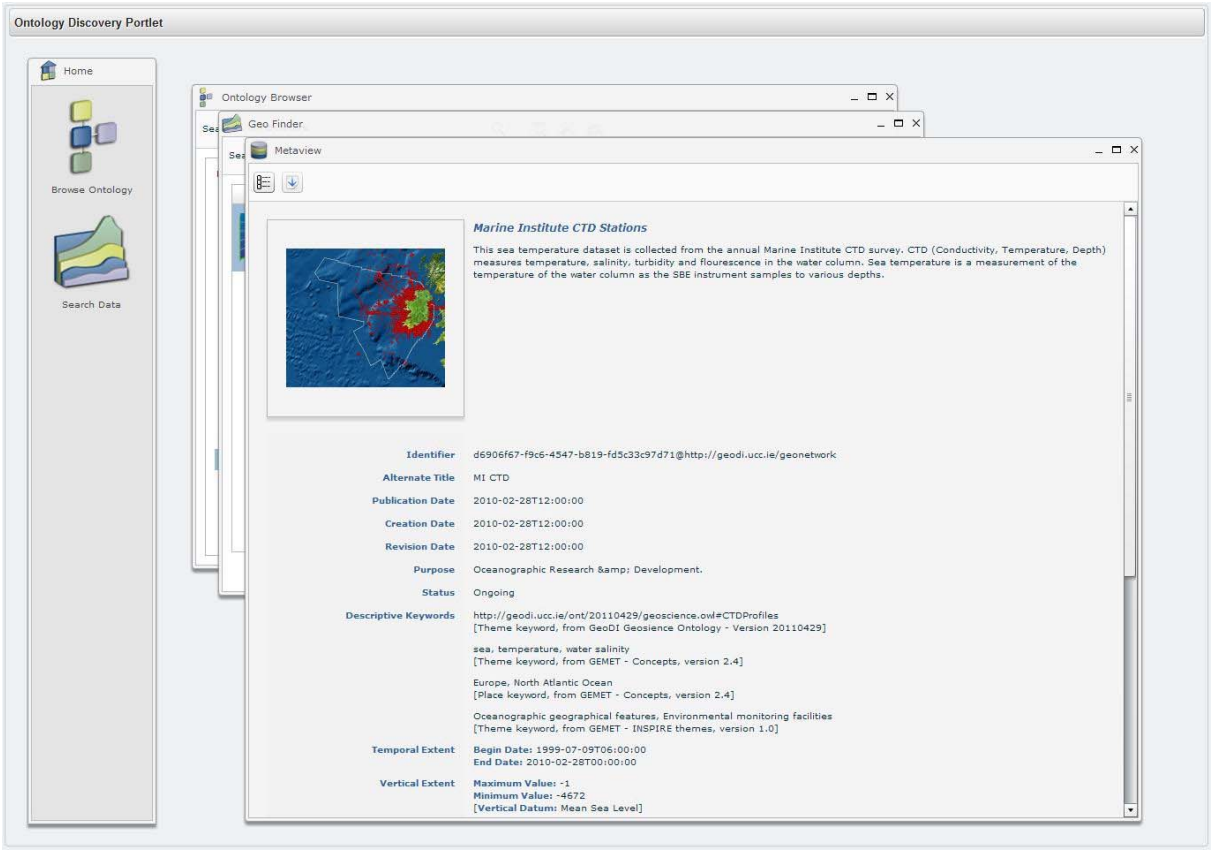

Figure 4-8 Ontology browser: Inspecting metadata for one of the found datasets.

4.3 Implementation

The smart search and discovery client includes the following features: an ontology browser, a smart search interface (discovery GUI), and a metadata viewer. It relies on two services: a semantic web service (SWS) and a CSW (Catalogue Service for the Web) mediator (CSWM), as illustrated in Figure 4-9.

The semantic web service (SWS) provides a high-level interface for retrieving knowledge from the NETMAR ontologies. The operations supported by the SWS are high-level and easy-to-use operations oriented towards querying SKOS (Simple Knowledge Organization System) thesauri [MB09]. They constitute common operations required by most semantics-based components such as the CSW mediator, the ontology browser, and the discovery GUI (Graphical User Interface). Examples of such operations include, *Get Concept Schemes*, *Get Concept Hierarchy*, *Get Related Concepts*, and *Search Concept*. The SWS is developed in Java, using the Jena ontology framework [Jena].

On top of the catalogue services, a CSW Mediator is responsible for handling metadata semantics and allows data discovery based on semantics. The CSWM supports distributed catalogue services, thus allowing new catalogue services to be integrated easily. The CSWM supports CSWM and CSW 2.0.2 XML requests and returns either a CSWM or a CSW 2.0.2 response (depending on the request standard) [CSW202]. It is developed in Java.

The ontology browser (OB) allows end-users to browse the ontologies with the aim of finding data types and datasets of interest. The OB allows users to better understand the meaning of the various topics (disciplines, themes, instruments, parameters, etc.) and how they relate to each other, and find in an accurate way data of relevance to their topics of interest. It

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allows them to search (by browsing or by keyword) concepts of interest, and from there navigate to the data discovery interface to find related datasets or services.

The smart data discovery interface, called Geo Finder, allows end-users to search datasets of interest based on the “meaning of a keyword” and a geographic area of interest. The current discovery GUI includes a basic ontology browser for place keywords that hold geospatial information encoded in GML (Geography Markup Language).

The metadata viewer, called Meta Viewer, is used to display metadata records of interest to the user. This will allow users to navigate from metadata to data and to the web GIS.

The ontology browser, the smart data discovery interface and the metadata viewer are all developed in Adobe Flex 3. To integrate these components in the EUMIS portal, this application had to be wrapped in a JSP (Java Server Pages) file, and configuration files defined to enable Liferay to recognise it as a portlet. All necessary files were compiled into a .war file, which was deployed in the portal container (Liferay).

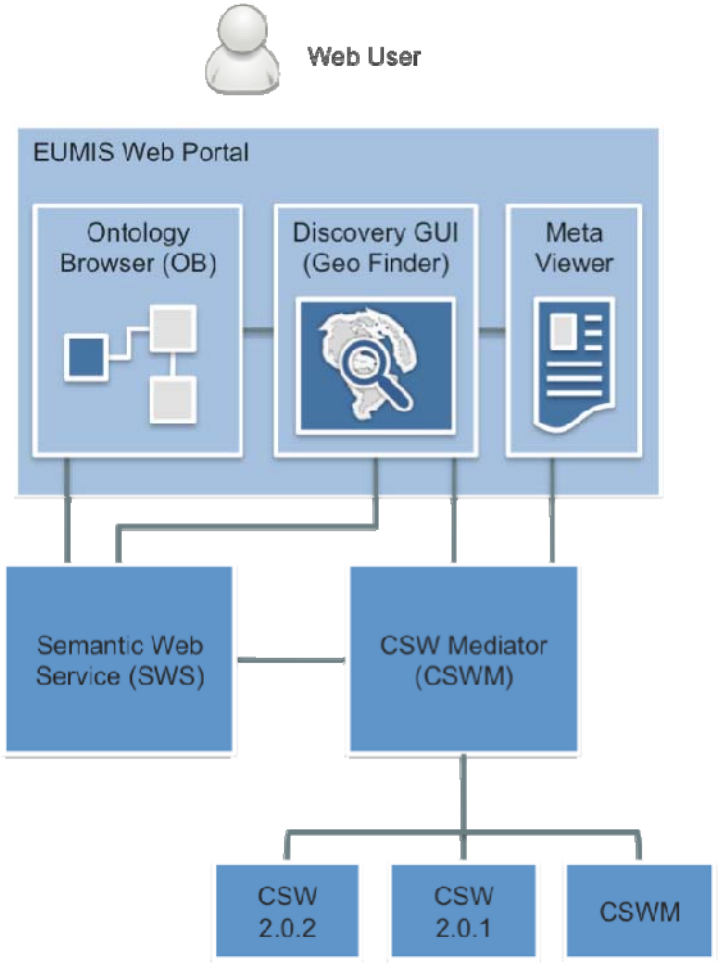

Figure 4-9 Smart search client components and services.

5 Service chaining editor

5.1 Purpose and features

One key aim of the NETMAR project is to enable non-technical users to build their own workflows using components (data and processing) provided by the project. These workflows could then be saved and reused by the user or published for use by others. The editor is available online via any commonly used web browser, as part of the EUMIS portal, and requires no special tools or plugins to be installed. The service chains (aka workflows) that are created by the editor can be executed by a workflow engine like Taverna [Tav].

The service chaining editor has the following features:

- Access to processing services offered by the NETMAR partner (and external parties, if available) through service announcements provided online as WDSL (Web Service Definition Language) files. These can be loaded into the editor, and the services added to the Service List for easy inclusion in the user's own workflows.
- WYSIWYG (What You See Is What You Get) editing of the workflows. The services are shown graphically in the editor's work area, where the users can connect them by linking the output from one service to the input of another.
- Storing of own workflows for later execution and (if desirable) sharing with other users. The workflows are stored in a standard format, allowing their execution in several workflow engines, both public domain and commercial tools.
- Loading of own (and others') workflows, editing of these and saving as new workflows.

5.2 How to use it

The service chaining editor allows the user to open a set of service definition stored in a WSDL file (Figure 5-1). The loaded services will be shown in a Service List (Figure 5-2), where clicking on a service will display the definition of its input parameters and what output is produced (Figure 5-3). A service can easily be dragged from the Service List to the Workspace (Figure 5-4(a)), and when it is placed in the Workspace the input and output is shown as green & red symbols (Figure 5-4(b)). Defining a workflow is easy; just drag the services needed to the Workspace and connect them by selecting input/output symbols and draw a line between them (Figure 5-5). A workflow can be saved in a file for running in a workflow engine like Taverna and for later editing (Figure 5-6).

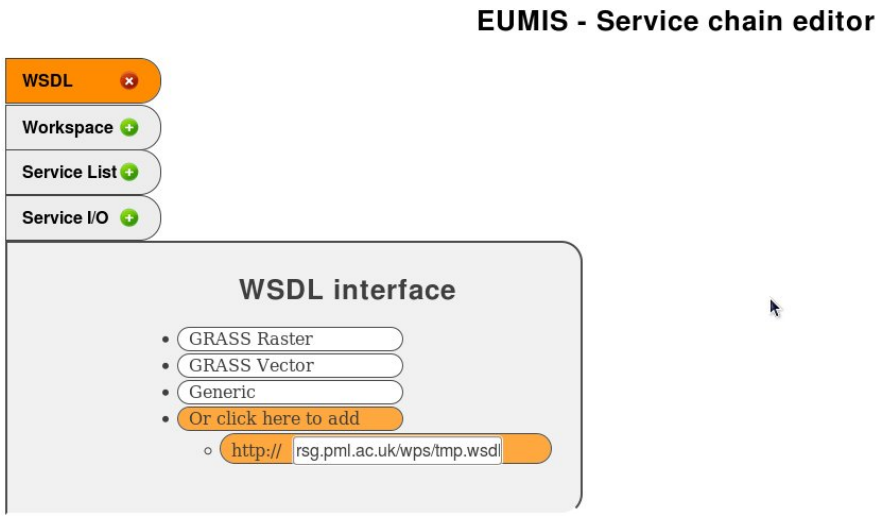

Figure 5-1 Service chaining editor: Loading services from a WDSL file.

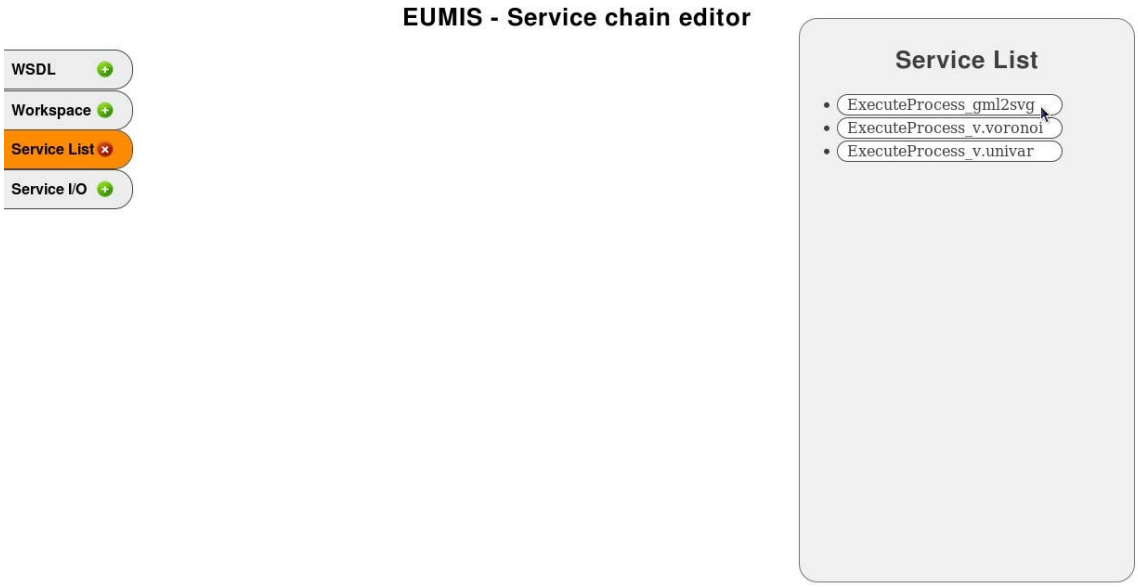

Figure 5-2 Service chaining editor: Selecting a service from the Service List.

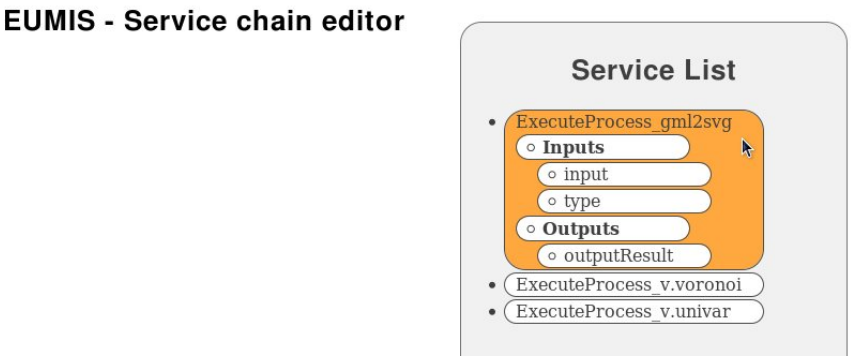

Figure 5-3 Service chaining editor: Viewing the interface of a service.

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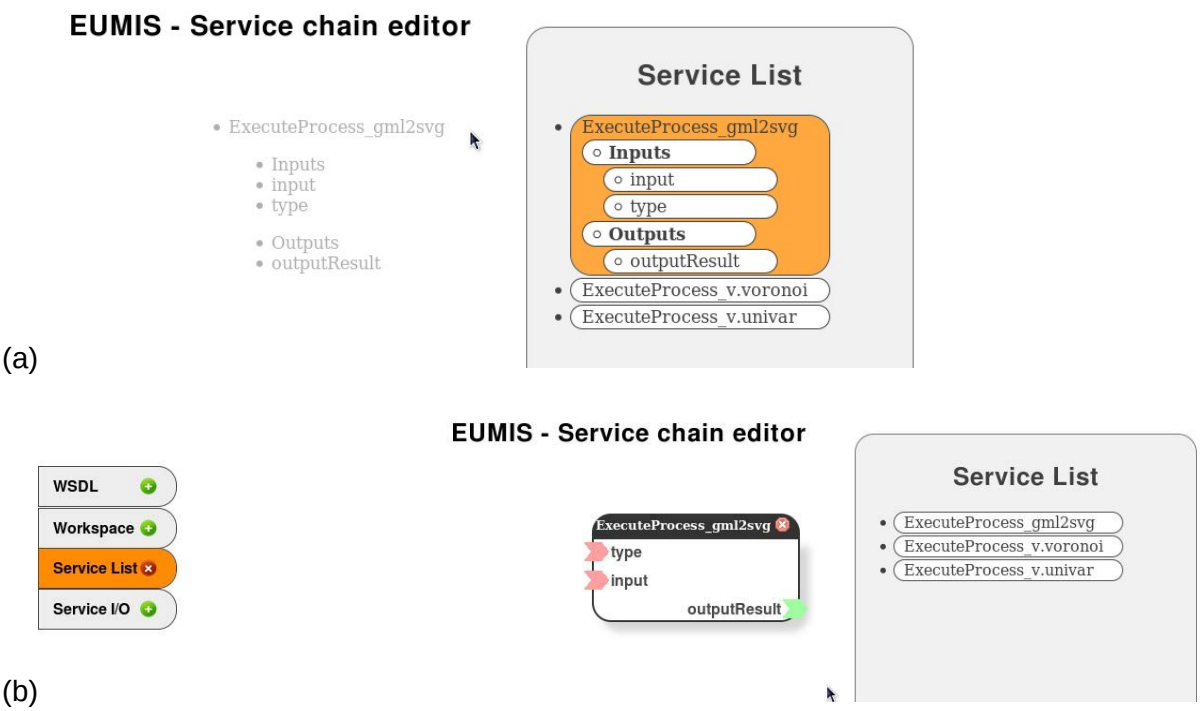

Figure 5-4 Service chaining editor: Adding a service to a workflow. Dragging it to the workspace (a) and representation of a service in the workspace (b).

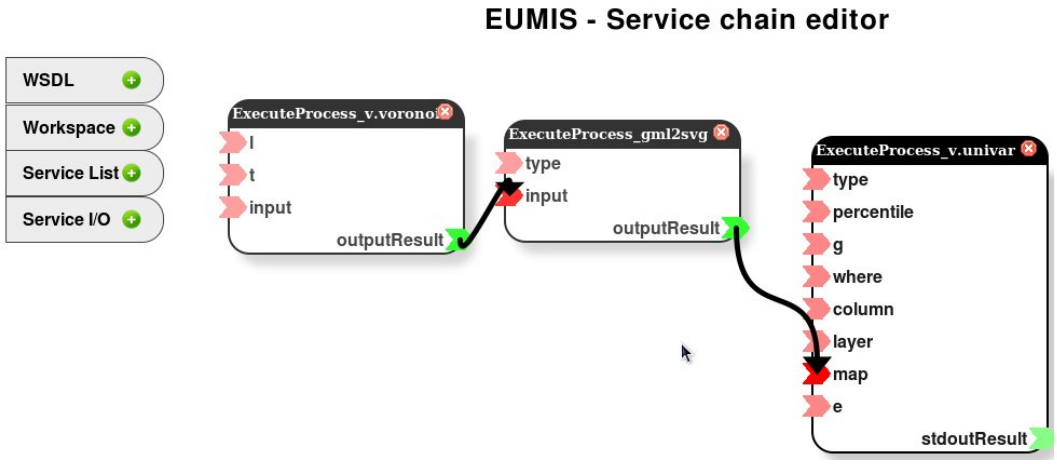

Figure 5-5 Service chaining editor: Setting up a workflow (service chain).

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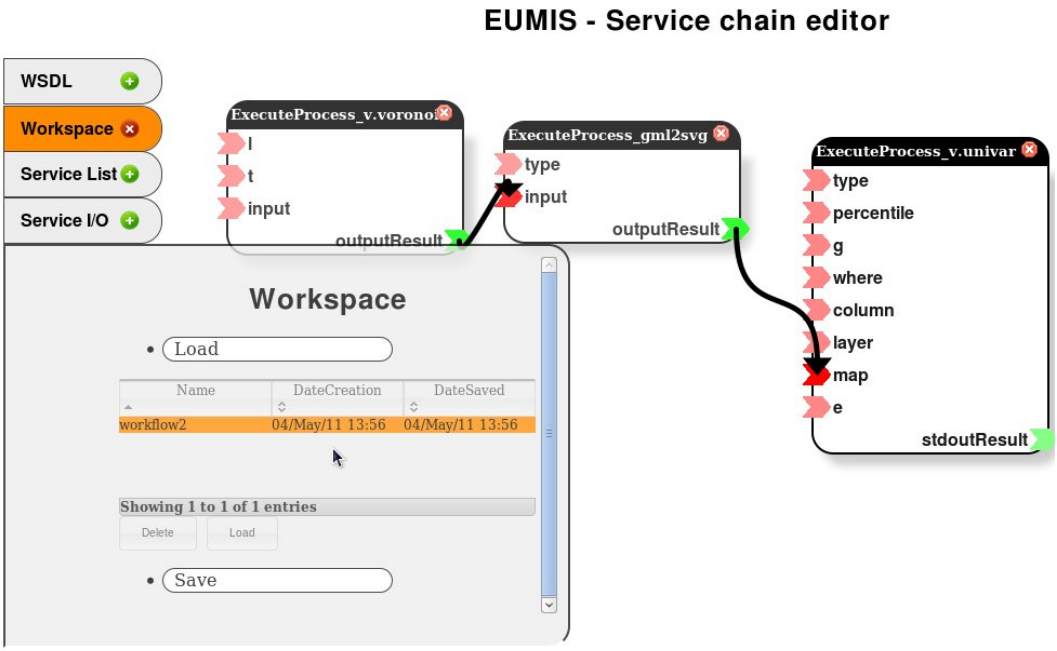

Figure 5-6 Service chaining editor: Saving a workflow to a file.

5.3 Implementation

The service chaining editor is implemented using HTML and JavaScript. The work area where the user connects services that are represented by graphical symbols is implemented using WireIt! [WI], which is an open source JavaScript library for creating and editing graphs. The graphs, which represent workflows, can be stored through an Ajax backend, Google Gears or any other method that allows a JSON object to be stored. The editor stores a workflow as SCUFL2 (an XML workflow language) [SCUFL2], which can be by the Taverna Server [Tav].

The layout of menus, buttons and the service composition area is controlled by means of jQuery [JQ]. jQuery is another open source JavaScript library that allows for creation of visually appealing and easy to use GUIs (Graphical User Interfaces). The GUI is styled by means of Cascading Style Sheets (CSS), which ensures the different components of the user interface are correctly positioned on the screen.

As the service chaining editor was first implemented as a standalone web application, it had to be wrapped in a JSP page before integration in the portal. A set of portlet configuration files also had to be created, declaring which JavaScript libraries and CSS files the editor needed.

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6 Conclusions

The first version of the EUMIS portal provides products and services for the following pilots:

- Pilot 1: Arctic Sea Ice and Met-ocean Observing System
- Pilot 2: Oil spill drift forecast and Shoreline Cleanup assessment services in France
- Pilot 3: Ocean Colour – Marine Ecosystem, Research and Monitoring.
- Pilot 4: The International Coastal Atlas Network (ICAN)

The requirements for each pilot have been defined by interacting with users in the respective application domains [PTS+11] through dedicated user meetings and workshops, followed by phone and e-mail contact.

The first version of the EUMIS portal contains a wiki and forum, where users can find information about the products and services offered, as well as the tools used to develop the portal, its components and data delivery and processing services. The portal also includes three GIS components: (1) the GIS Viewer, (2) the search and discovery client, and (3) the service chaining editor.

The portal wiki and forum provide an overview of the products and services that are offered by EUMIS, and how to use the different tools in the portal. The portal home page offers pointers to these resources, as well as information on selected products and services, relevant news feeds and announcements of workshops and other venues where products and services are presented. All content in the wiki and forum are open to everyone, and both the wiki and forum can be searched by free text search. Users can also register in the portal. This will give them access to more services, and the ability to ask questions in the forum.

The GIS Viewer allows users to display on a map distributed geo-spatial resources that have been shared by means of the OGC WMS standard. It provides a user-friendly way of browsing WMS servers to see what features they have available, choosing those of interest, and seeing the resulting map. The GIS viewer allows the user to obtain multiple layers overlaid on top of one another in the same geographic map projection. If the WMS server supports it, a user can click on a feature to get additional information about it, such as the values measured by an in situ sensor. Layers can be added and removed dynamically, and their display easily turned on and off. The GIS map viewer also includes common GIS functions (e.g. zoom, pan, legends), shows the latitude-longitude location of the cursor inside a map, and facilitates printing of the currently displayed layers.

Smart search is the ability of a discovery engine to locate target documents that do not include either an exact or fuzzy match to a user-supplied text string or user-supplied keyword. For example, if the user initiates a search on the discipline keyword ‘Physical Oceanography’, the discovery engine find documents marked up with terms like ‘currents’, ‘waves’, ‘water temperature’, ‘salinity’ and so on, because these are semantically linked to the search criteria. The smart search and discovery client supports three features: ontology browsing, dataset smart search, and metadata visualisation. It provides search facilities based on the *semantics* of the data, including support for multi-domain and multi-lingual search in a network of metadata catalogue services connected by a mediator tool.

The service chaining editor allows users to generate new products by specifying workflows that utilise a set of data delivery and processing services. The workflow is generated using a graphical editor where individual services are chained together to form a new process. The workflows can be saved for later use, re-opened and edited, and exported to a workflow engine like Taverna for execution and display of the resulting product.

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7 References

[CSDI] Constellation-SDI, http://constellation.codehaus.org/ (accessed 11 June 2011)

[CSW202] OpenGIS Catalogue Service Specification, Version 2.0.2, OGC 07-006r1. Online at http://portal.opengeospatial.org/files/?artifact_id=20555 (accessed on 22 April 2010).

[GS] Geoserver, http://geoserver.org/display/GEOS/Welcome (accessed 11 June 2011)

[GT] The Geotoolkit.org library, http://www.geotoolkit.org/ (accessed 12 July 2011)

[JAI] Java Advanced Imaging (JAI) 1.1.3, http://download.java.net/media/jai/builds/release/1_1_3/ (accessed 5 July 2011)

[JAIIO] Java Advanced Imaging I/O (JAI Image-I/O) libraries Image I/O 1.1: http://download.java.net/media/jai-imageio/builds/release/1.1/ (accessed 5 July 2011)

[Jena] Jena – A Semantic Web Framework for Java, http://jena.sourceforge.net/ (accessed 12 July 2011)

[JQ] jQuery, http://jquery.com/ (accessed 11 June 2011)

[LRv6] Liferay Community Edition, http://www.liferay.com/downloads/liferay-portal/available-releases (accessed 30 May 2011).

[MB09] Miles, A., and Bechhofer, S.: SKOS Simple Knowledge Organization System: Reference. W3C Recommendation. 18 August 2009. Available online at: http://www.w3.org/TR/2009/REC-skos-reference-20090818/

[MF] MapFaces, http://mapfaces.codehaus.org (accessed 31 May 2011)

[MS] MapServer, http://mapserver.org/ (accessed 11 June 2011)

[NCW] ncWMS trac, http://www.resc.rdg.ac.uk/trac/ncWMS/ (accessed 27 July 2011)

[OL] OpenLayers, http://openlayers.org (accessed 30 May 2011)

[PTS+11] Pladsen, Jan Ivar, Mickael Treguer, Stein Sandven, et. al, 2011. D1.1 Use case specification and schedule for testing. NETMAR (Open service network for marine environmental data) Deliverable D1.1. European Commission Information Society and Media Directorate-General Grant Agreement Number 249024. Revised version, June 2011.

[RFC2396] Network Working Group, 1998. Uniform Resource Identifiers (URI): Generic Syntax, http://www.ietf.org/rfc/rfc2396.txt (accessed 11 June 2011).

[SCUFL2] http://www.mygrid.org.uk/dev/wiki/display/developer/2010-07+SCUFL2 (accessed 07 June 2011)

[Tav] Taverna workflow management system, http://www.taverna.org.uk/ (accessed 30 May 2011)

[WI] WireIt!, http://neyric.github.com/wireit/ (accessed 30 May 2011)

[WMC05] OpenGIS Web Map Context Implementation Specification, version 1.1.0, http://www.opengeospatial.org/standards/wmc (accessed 12 July 2011)

[WMS13] OGC Web Map Service (WMS) Implementation Specification, version 1.3.0, OGC 06-042, Online at http://portal.opengeospatial.org/files/?artifact_id=14416 (accessed 21 April 2010)

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