



## **EUMIS - an open portal framework for interoperable marine environmental services**

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NETMAR (Open service network for marine environmental data) is an FP7 project that 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.

Four pilots have been defined to clarify the needs for satellite, in situ and model based products and services in selected user communities. The pilots are:

- Pilot 1: Arctic Sea Ice Monitoring and Forecasting
- Pilot 2: Oil spill drift forecast and shoreline cleanup assessment services in France
- Pilot 3: Ocean colour - Marine Ecosystem, Research and Monitoring
- Pilot 4: International Coastal Atlas Network (ICAN) for coastal zone management

NETMAR is developing a set of data delivery services for the targeted user communities by means of standard web-GIS and OPeNDAP protocols. Processing services and adaptive service chaining services will also be developed, to enable users to generate new products suited to their needs. Both data retrieved from online repositories as well as the products generated dynamically can be accessed and visualised in the EUMIS portal. For this purpose, a GIS Viewer, a Service Chaining Editor and a Ontology Browser/Discovery Client have been developed and integrated in EUMIS.

The EUMIS portal is developed using a portal framework that is compliant with the JSR-168 (Java Portlet Specification 1.0) and JSR-286 (Java Portlet Specification, 2.0) standards. These standards defines the interface (contract) and lifecycle management for a portal system component, a portlet, which can be implemented in a number of programming languages, not only Java. The GIS Viewer is developed using a combination of Java, JavaScript and JSF (e.g. MapFaces). The Service chaining editor is implemented in JavaScript (using different libraries like jQuery and WireIt), and the Ontology Browser/Discovery Client by means of Adobe Flex. In addition to the portlets developed in the project, we have also used several of the pre-built portlets that come with the Liferay Community Edition portal framework, notably the wiki, forum and RSS feed portlets.

The presentation will focus on the developed system components and show some examples of products and services from the defined pilots.



## **Creating OGC Web Processing Service workflows using a web-based editor**

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The OGC WPS (Web Processing Service) specifies how geospatial algorithms may be accessed in an SOA (Service Oriented Architecture). Service providers can encode both simple and sophisticated algorithms as WPS processes and publish them as web services. These services are not only useful individually but may be built into complex processing chains (workflows) that can solve complex data analysis and/or scientific problems.

The NETMAR project has extended the Web Processing Service (WPS) framework to provide transparent integration between it and the commonly used WSDL (Web Service Description Language) that describes the web services and its default SOAP (Simple Object Access Protocol) binding. The extensions allow WPS services to be orchestrated using commonly used tools (in this case Taverna Workbench, but BPEL based systems would also be an option).

We have also developed a WebGUI service editor, based on HTML5 and the WireIt! Javascript API, that allows users to create these workflows using only a web browser. The editor is coded entirely in Javascript and performs all XSLT transformations needed to produce a Taverna compatible (T2FLOW) workflow description which can be exported and run on a local Taverna Workbench or uploaded to a web-based orchestration server and run there.

Here we present the NETMAR WebGUI service chain editor and discuss the problems associated with the development of a WebGUI for scientific workflow editing; content transformation into the Taverna orchestration language (T2FLOW/SCUFL); final orchestration in the Taverna engine and how to deal with the large volumes of data being transferred between different WPS services (possibly running on different servers) during workflow orchestration.

We will also demonstrate using the WebGUI for creating a simple workflow making use of published web processing services, showing how simple services may be chained together to produce outputs that would previously have required a GIS (Geographic Information System) locally.



## Using SOA Patterns to promote understanding across disciplines

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The NETMAR consortium is building an open service network for marine environmental data by combining expertise from Ireland, France, the UK and Norway in disciplines such as Semantics, Software Engineering, UI Programming and Service Orchestration. Through the International Coastal Atlas Network, it engages user groups from Europe, Africa, Asia and the Americas. In doing so, it faces challenges in bringing these disciplines and groups together in a way that makes them greater than the sum of their parts.

Service Oriented Architecture has been successfully applied in many cases to help build useful systems across organisational and geographic boundaries in order to expose diverse capabilities which can function together through a mutual exchange of value. This should make it ideally suited to a distributed decision making environment without centralised command and control. In theory, SOA should facilitate the building of global and complex infrastructures and the integration of information systems characterized by diverse protocols and interfaces, and with different data policies and security levels.

The presentation will discuss a number of approaches used by NETMAR to bring the theory of SOA to bear in a useful way while maintaining the emphasis on keeping multi-disciplinary domain expertise as the primary driver of the project. It will discuss three approaches used:

- . Populating one or more standard reference models
- . Trade-off analysis based on business drivers and quality attributes
- . Documenting design reuse in the form of patterns.

The three approaches will be compared in terms of how they succeed in bringing 'just enough' service architecture knowledge into the project. We discuss how the approaches can interact and complement each other. Finally, we present a number of SOA patterns identified as being relevant to NETMAR and explain why they are felt to be particularly effective in gaining consensus on how to build the NETMAR system of systems.



## The NERC Vocabulary Server: Version 2.0

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The NERC Vocabulary Server (NVS) has been used to publish controlled vocabularies of terms relevant to the marine environmental sciences domain since 2006 (version 0) with version 1 being introduced in 2007. It has been used for

- metadata mark-up with verifiable content
- populating dynamic drop down lists
- semantic cross-walk between metadata schemata
- so-called smart search
- and the semantic enablement of Open Geospatial Consortium Web Processing Services

in projects including: the NERC Data Grid; SeaDataNet; Geo-Seas; and the European Marine Observation and Data Network (EMODnet).

The NVS is based on the Simple Knowledge Organization System (SKOS) model and following a version change for SKOS in 2009 there was a desire to upgrade the NVS to incorporate the changes in this standard. SKOS is based on the “concept”, which it defines as a “unit of thought”, that is an idea or notion such as “oil spill”. The latest version of SKOS introduces the ability to aggregate concepts in both collections and schemes. The design of version 2 of the NVS uses both types of aggregation: schemes for the discovery of content through hierarchical thesauri and collections for the publication and addressing of content.

Other desired changes from version 1 of the NVS included:

- the removal of the potential for multiple Uniform Resource Names for the same concept to ensure consistent identification of concepts
- the addition of content and technical governance information in the payload documents to provide an audit trail to users of NVS content
- the removal of XML snippets from concept definitions in order to correctly validate XML serializations of the SKOS
- the addition of the ability to map into external knowledge organization systems in order to extend the knowledge base
- a more truly RESTful approach URL access to the NVS to make the development of applications on top of the NVS easier
- and support for multiple human languages to increase the user base of the NVS

Version 2 of the NVS underpins the semantic layer for the Open Service Network for Marine Environmental Data (NETMAR) project, funded by the European Commission under the Seventh Framework Programme.

Here we present the results of upgrading the NVS from version 1 to 2 and show applications which have been built on top of the NVS using its Application Programming Interface, including a demonstration version of a SPARQL interface.