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Ontology System for Survey Event characterization on Research Vessels

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The FP7 Eurofleets project is an alliance of 24 marine research centres across Europe with the view to work together and share resources, improving the quality of marine research in Europe. Among the many goals the project has, a very important task is the development of an event log software called EARS (Eurofleets Automatic Reporting System) that enables scientists and operators to record what happens during a survey. EARS will allow users to fill, in a standardized way, the gap existing at the moment in metadata description that only very seldom links data with its history. Events generated automatically by acquisition instruments will also be handled, enhancing the granularity and precision of the event annotation.

Quality and completeness of the metadata improves when recorded accurately at the origin of the measurement. This information forms a primordial step in the process of data quality control as it could assist in the understanding of anomalies and unexpected trends recorded in the acquired data sets. And, the possibility of automatically reporting metadata and data, will simplify the work of scientists and data managers with regards to data transmission.

The work presented consists of the development of an ontology system to be used as a knowledge base for the EARS.

Being Eurofleets a multinational initiative that involves people with different profiles and technological specialities from various marine scientific disciplines, the knowledge base should be referred to from different languages and respond to different needs and concepts regarding all event information to log. The construction of this knowledge base, which was absolutely not trivial, has been accomplished using a formal methodology to build applications and systems based on Semantic Web Services. The key of such methodology is to drive the development from the definition of use cases, meaning the analysis of our needs, separating the conceptual work from the implementation, and from the tools that will eventually be used to achieve it.

Our work takes as references other international initiatives that built semantic frameworks for marine concepts, and also wants to incorporate well established controlled vocabularies used in the marine and environmental sciences.

The model is based on the definition of an event as an action happening to a subject/tool at a given time and performed by a certain actor at sea, for example: closure of a "Niskin" bottle by an operator or setting the depth of the streamer by a technician. The concept is setup for a wide range of actions to account for any possible event during a cruise, including any malfunction occurring or any observations done.

From that point it has been possible to identify the fundamental pieces of information that form an event, their relevance (if they are mandatory or not), the relationships between them (if existing) and the constraints or axioms that govern them. We have also identified which ones of these fundamental pieces of information, must be regulated, in its content, by a controlled set of terms. All this forms the conceptual model of our domain that can be considered formally as an ontology for marine survey events.
Our ontology has helped us to reach a common way to understand and use events inside the Eurofleets community, allowing us to systematically address such concept and to be rigorous in our approach to the shared and multilingual concepts.

The ontology has been used to build a smart user interface for the event recording process. Grouping con-

cepts in categories with explicit relationships allows the construction of user choice boxes that change their contents based on previous user choices. For example the possible actions for an event depend on the particular instrument subject of it.
The ontology allows us to map concepts of other marine domain ontologies, enriching our domain knowledge and also providing us a formal way to develop a multilingual controlled vocabulary for our scenario that at same time incorporates existing ones like those of the SeaDataNet initiative.