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Implementation of UML Schema to RDBM

M. Nagni, S. Ventouras, and G. Parton

Centre for Environmental Data Archival, Rutherford Appleton Laboratory, Didcot, Oxfordshire, United Kingdom (maurizio.nagni@stfc.ac.uk)

Multiple disciplines – especially those within the earth and physical sciences, and increasingly those within social science and medical fields – require Geographic Information (GI) i.e. information concerning phenomena implicitly or explicitly associated with a location relative to the Earth [1]. Therefore geographic datasets are increasingly being shared, exchanged and frequently used for purposes other than those for which they were originally intended.

The ISO Technical Committee 211 (ISO/TC 211) together with Open Geospatial Consortium (OGC) provide a series of standards and guidelines for developing application schemas which should: a) capture relevant conceptual aspects of the data involved; and b) be sufficient to satisfy previously defined use-cases of a specific or cross-domain concerns. In addition, the Hollow World technology offers an accessible and industry-standardised methodology for creating and editing Application Schema UML models which conform to international standards for interoperable GI [2].

We present a technology which seamlessly transforms an Application Schema UML model to a relational database model (RDBM). This technology, using the same UML information model, complements the XML transformation of an information model produced by the FullMoon tool [2].

In preparation for the generation of a RDBM the UML model is first mapped to a collection of OO classes and relationships. Any external dependencies that exist are then resolved through the same mechanism. However, a RDBM does not support a hierarchical (relational) data structure – a function that may be required by UML models. Previous approaches have addressed this problem through use of nested sets or an adjacent list to represent such structure.

Our unique strategy addresses the hierarchical data structure issue, whether singular or multiple inheritance, by hiding a delegation pattern within an OO class. This permits the object-relational mapping (ORM) software used to generate the RDBM to easily map the class into the RDBM. In other words the particular structure of the resulting OO class may expose a “composition-like aspect” to the ORM whilst maintaining an “inherited-like aspect” for use within an OO program.

This methodology has been used to implement a software application to manages the new CEDA metadata model which is based on MOLES 3.4, Python, Django and SQLAlchemy.

References

1. ISO 19101. Geographic information — Reference model. International Organization for Standardization, 2002.
2. P. Colodoniuc and S. Cox, Application schema modelling for interoperable geospatial information using the ISO 19100 series of standards