CASE STUDY

GEOSCIENCE AUSTRALIA AND CSIRO
Developing the GeoSciML interoperability standard with Enterprise Architect

CHALLENGE

The integration of heterogeneous data continues to present challenges to all sectors of industry,commerce and government. The effective management of resources and the environment by the geoscience community requires accessibility to all the data about the planet that is available.

WHY ENTERPRISE ARCHITECT

The tool had to provide an easy to use and intuitive interface.This meant that minimum time was required to learn how to use it and the time saved could be re-allocated to refining UML skills and knowledge. When compared with alternatives, Sparx Systems' Enterprise Architect immediately stood out as having a well designed User Interface, and was simple to use, but not at the expense of oversimplifying the underlying modelling language.

BENEFIT

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The integration of heterogeneous data continues to present challenges to all sectors of industry, commerce and government. The effective management of resources and the environment by the geoscience community requires accessibility to all the data about the planet that is available. Given the high availability of geoscience data, it is essential the geoscience community has the ability to communicate and collaborate.

GeoSciML (GeoScience Markup Language), an application of GML (Geography Markup Language), was developed to represent geoscience information associated with geologic maps and observations and to support the interchange of geoscience information.

The GeoSciML project was initiated in 2003, under the auspices of the Commission for Geoscience Information (CGI) working group on Data Model Collaboration. The project is part of what is known as the CGI Interoperability Working Group.

Simon Cox, a Research Scientist with CSIRO Exploration and Mining Division, and Nick Ardlie, from Geoscience Australia, have both been involved with the development of GeoSciML.

The project members chose Sparx Systems' Enterprise Architect as the modelling tool for developing the GeoSciML specification.

The modeling tool requirements included (i) the need for UML 2.0 compliant diagramming, and (ii) the ability to export in open-standard formats, facilitating the exchange of model contents and components.

It was clear that Sparx Systems had invested a lot of time in Enterprise Architect to support the key versions of XML."

— Nick Ardlie
Software Engineer,
Geoscience Australia

Identification

The initial focus was on usability when identifying the right tool. The tool had to provide an easy to use and intuitive interface. This meant that minimum time was required to learn how to use it and the time saved could be re-allocated to refining UML skills and knowledge. When compared with alternatives, Sparx Systems' Enterprise Architect immediately stood out as having a well designed User Interface, and was simple to use, but not at the expense of oversimplifying the underlying modelling language. The tool allowed users to start simply and progressively add complexity depending on needs. Enterprise Architect was more polished all round, and considerably more affordable, than commercial competitors.

Purchasing Considerations

Strict UML compliance was the most important factor in the decision to purchase Enterprise Architect, but other real considerations were usability, value for money, configuration management capability, and standardised import/export capabilities. On the last point, which is really about XML Metadata Interchange (XMI) standards compliance, Nick observed "it was clear that Sparx Systems had invested a lot of time in Enterprise Architect to support the key versions of XMI."

Key Selection Criteria

Simon observed, "the information modelling requirements within this area are quite complex, so, importantly, the tool needed to be up to the task of complex class modeling." Enterprise Architect was initially trialed by Simon Cox on the recommendation of industry colleagues, who are also active participants in the Geospatial Information Standards domain.

Deployment Strategy

The deployment strategy was simple. A number of licences were deployed across CSIRO and Geoscience Australia, both for Geospatial Information modelling and for other, more typical, software engineering projects. Based on identified need, licences were purchased and deployed as required. The work that Simon and Nick undertook with UML increasingly involved collaboration with colleagues based in other organizations. In this context it was important to be able to share model artifacts at a useful aggregation level. Enterprise Architect's support for externally governed packages was critical to supporting this teamwork. The affordability of Enterprise Architect meant there was essentially no barrier to deploying additional licenses within the organisations, as additional team members were brought onto various projects.

Task Overview

A sizable information model called “HollowWorld” was initially developed by Simon. HollowWorld is an environment to enable specialists in a domain that utilizes Geospatial Information to develop an information model for their application domain, which conforms to international standards for interoperable Geospatial Information. The framework is that provided by the ISO 19100 series of standards. This is augmented by some additional components useful for natural science and environmental monitoring applications.

At Geoscience Australia, HollowWorld has been used within the Enterprise Architect environment to develop and collaborate on interoperable information models for the Geosciences. One example of such a model is GeoSciML.

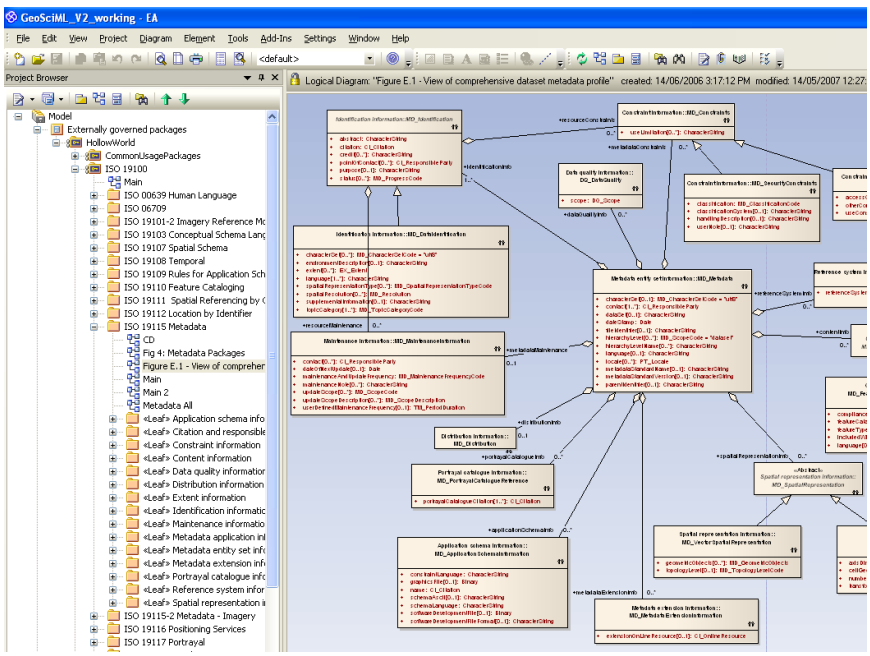

Figure 1 The HollowWorld libraries viewed from within the GeoSciML project

GeoSciML accommodates the short-term goal of representing Geoscience Information associated with geologic maps and observations, as well as being extensible in the long-term to other geoscience data. It draws from many geoscience data model efforts, and from these, establishes a common suite of feature types based on geological criteria (units, structures, fossils) or artefacts of geological investigations (specimens, sections, measurements). Supporting objects are also considered (timescale, lexicons, etc), so that they can be used as classifiers for the primary objects.

According to Nick, “in addition to GeoSciML we are working on similar models in the areas of Geochronology, Geochemistry and Landslides.”

"Enterprise Architect has provided a great framework, not just for developing the information model, but also providing package level configuration management of model components so that participants in different countries and time zones can concurrently work on the model. Enterprise Architect's integration with Subversion is a critical component to achieving this."

Simon added that "CSIRO are using Enterprise Architect and HollowWorld in a similar vein to develop a model for Water Resources Information within CSIRO, and expect it to be an important tool in a recently-initiated international project in this space."

Use of Standards

The ISO 19100 series of standards is concerned with the International Standardisation of Geographic information. The ISO 19103 defines a Conceptual Schema Language for this series of standards, using a subset of the UML Class Diagram set. ISO 19109 takes this a step further and prescribes a set of rules for developing a conceptual schema to define the content and structure of "Features" for a given domain of interest.

ISO 19103 and 191909 therefore assist the development of a conceptual class model, but how is this model intended to be implemented? ISO 19118 provides a set of "Encoding Rules" that allow an XML Schema to be generated from the UML source model. The generated schemas rely on the ISO 19136 (GML) to provide an interoperable representation of spatial information.

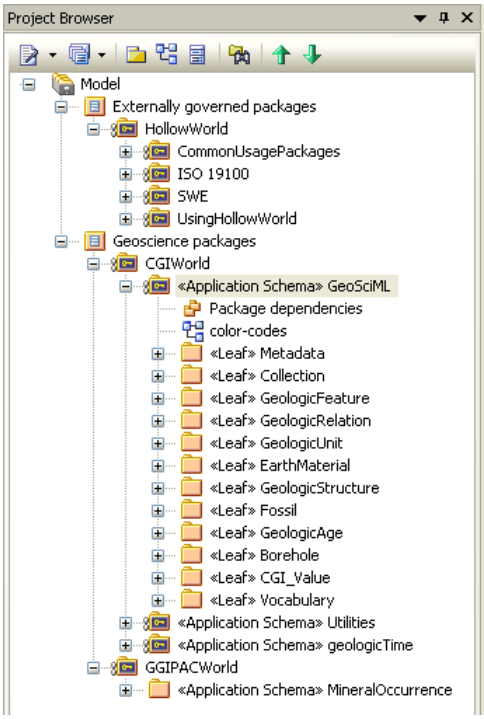

Figure 2 Externally governed GeoSciML packages in Enterprise Architect's Project Browser

Nick explains, "The process described here can be considered a Model Driven Architecture (MDA). Our primary artifact is the UML model (which we manage in Enterprise Architect). Our implementation model, and other artifacts such as model documentation, can then be automatically generated from the source model."

On interoperability and customer choice Nick noted, “The ability to manage and export models in an interoperable XMI format is a key feature for us. We use these XMI encodings of the class models as the true source of our MDA model. It provides a standardised and vendor-neutral means to generate the various model artefacts we require for implementation. Because the XMI representation is just an XML, document it facilitates transformation processing using open standards.”

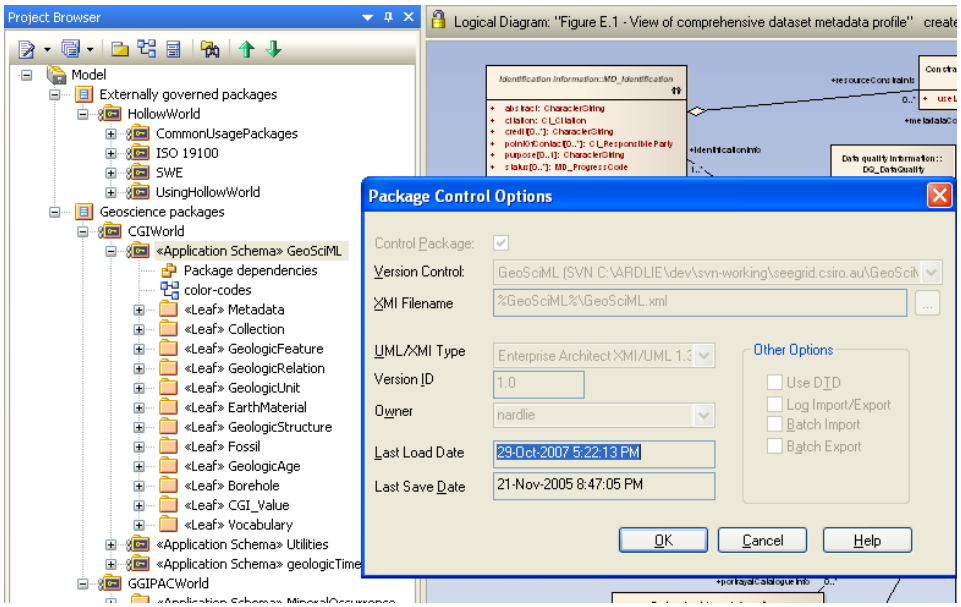

Figure 3 GeoSciML Package Control - showing XMI management of packages

“For instance, we’re currently developing a processing framework that represents processing and conformance rules in the XQuery language. A suite of XQuery statements can then be applied to the XMI model to generate various outputs.”

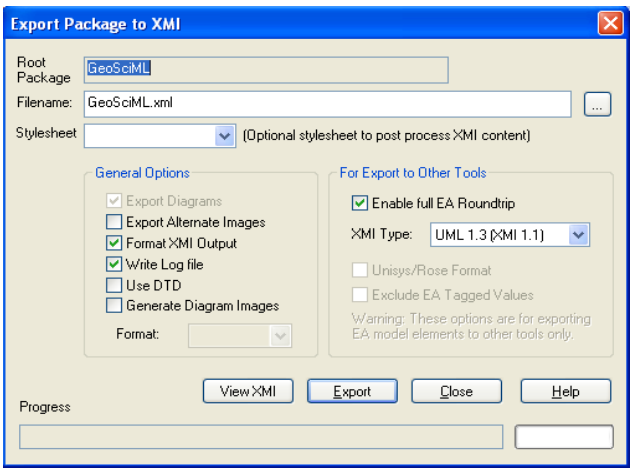

Figure 4 Alternatively, XMI export allows for the inclusion of class diagram images in custom documentation

"Support for UML profiles is a must for our work also, as is the Subversion configuration management capability."

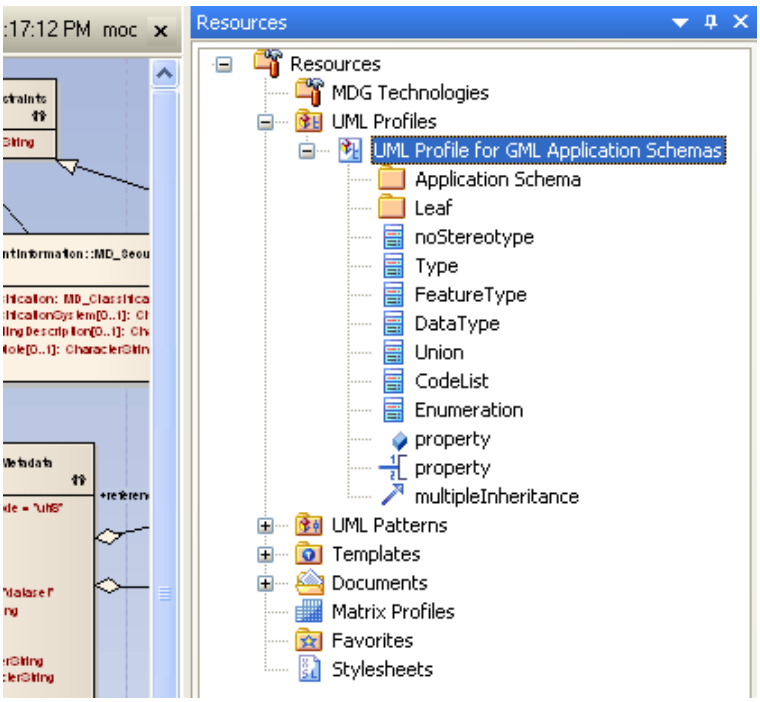

Figure 5 The UML Profile for GML Application Schemas

Benefits of Sparx Systems' Enterprise Architect

According to Nick "Enterprise Architect has certainly allowed us to roll out a professional UML modelling tool to a far greater user base across the organization mainly because of its affordability."

Simon added "Enterprise Architect has allowed us to use a rigorous modelling environment routinely."

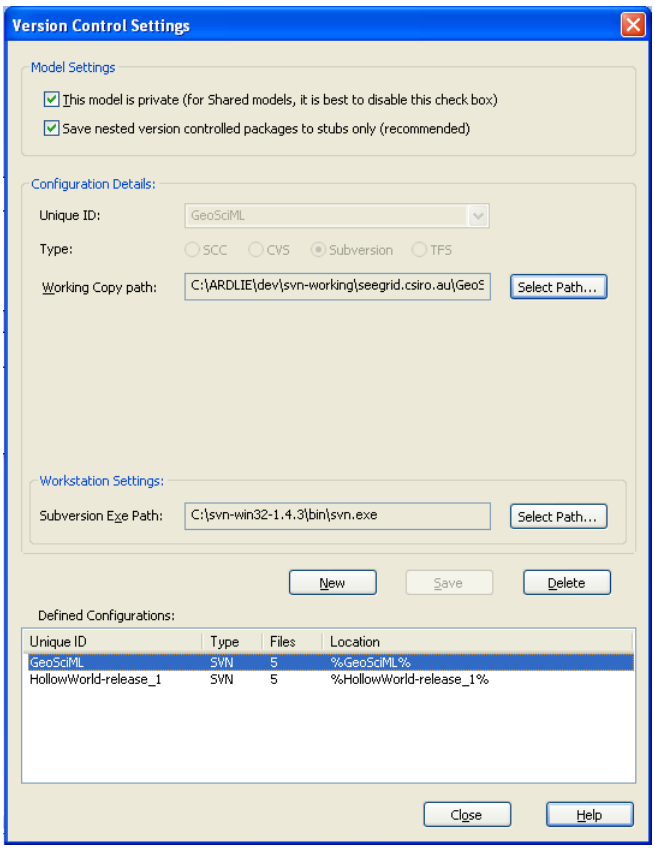

Figure 6 GeoSciML Enterprise Architect Project Version Control - showing separate configurations for dependant projects

Future application for INSPIRE

GeoSciML is already endorsed in Australia, Canada and the US, and proposed to be used in INSPIRE (INfrastructure for SPatial InfoRmation in Europe). It will be an IUGS (International Union of Geological Sciences) endorsed conceptual model of GeoScience that everyone can use to exchange geoscience data.

The overall objective of the INSPIRE initiative is to make harmonised and high quality spatial (geographic) information readily available for policy development for environment in Europe. This will be extended to agriculture, transport, and other sectors, as well as facilitating access by citizens and business to spatial information, whether at local, regional, national or international levels.

Summary

Because it facilitates a level of communication and standards based data sharing that has hitherto been denied, the development of GeoSciML has exciting implications for the global geoscience community and the larger geospatial community. The ability to share data and knowledge openly, based on standards, leads to more and better decision making, time saving, cost reduction, reduced risk, higher productivity and improved ability to meet compliance obligations. When combined, these benefits represent a significant contribution to national and global prosperity.

GeoSciML is intended for use by data portals publishing data for customers in GeoSciML, for interchanging data between organisations that use different database implementations and software/systems environments, and in particular, for use in geoscience web services. In this way, GeoSciML allows applications to utilize globally distributed geoscience data and information.

The successful development of GeoSciML was enabled by Enterprise Architect's economy of industrial strength, technical reliability and ability to share very big models between large, globally distributed teams, combined with affordable access to the technology by all who required it.

Enterprise Architect is selected by both advanced and novice users as the tool of choice, because it delivers rich functionality at a competitive price. It has supported the development of GeoSciML, and on the basis of the above, has been recommended to support emerging initiatives that will use GeoSciML. Exchanging data is sharing knowledge. Shared knowledge creates a synergy where the sum of the parts is greater than the whole. This is the benefit from the use of GeoSciML which can be realized not only by those practicing within, and served by the Geoscience community, but by many other communities of practice.

About the Authors

Dr Simon Cox

Dr Simon Cox is a Research Scientist with CSIRO Exploration and Mining. He is based at the Australian Resources Research Centre (ARRC) in Kensington, Western Australia.

Dr Cox is one of the initiators and driving forces behind the Solid Earth and Environment Grid (SEEGrid). SEEGrid functions as an umbrella for the development of community-managed informational and computational service standards for geospatial data. Dr Cox is currently leading the GeoSciML project.

Nicholas Ardlie

Nick Ardlie is a Software Engineer currently working for Geoscience Australia in the Geospatial Information Standards area. He has significant experience in design and delivery of Enterprise Software solutions using XML and Web Service technologies, and enterprise systems design and development within the Service Oriented Architecture (SOA) model.

Nick's subject matter expertise is in Geospatial information services and associated standards/technologies (OGC and ISO standards).

Geoscience Australia

Within the portfolio of Industry, Tourism and Resources, Geoscience Australia plays a critical role by producing first-class geoscientific geospatial information and knowledge. This can enable the government and the community to make informed decisions about the exploration of resources, the management of the environment, the safety of critical infrastructure and the resultant wellbeing of all Australians.

CSIRO

CSIRO, the Commonwealth Scientific and Industrial Research Organisation, is Australia's national science agency and one of the largest and most diverse research agencies in the world.

See http://www.csiro.au/org/AboutCSIRO.html

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