EarthCube's Earth System Bridge - Simplifying the Reuse and Interoperability of Computational Geoscience Models

The Earth System Bridge is one of the NSF-funded EarthCube building block projects that has created a variety of tools and technologies that make it much easier to reuse and couple computational models from different science domains. Coupled Earth System Models are needed and are routinely used to understand and predict the environmental hazards of weather/climate, ecology and deep Earth processes. However, computational models typically differ in numerous ways, including their programming language, computational grid, computed variables/units, time-stepping scheme and underlying assumptions. It is therefore quite difficult and time-consuming to reuse them in new contexts, in new configurations or across disciplinary boundaries. It turns out that the key to making heterogenous models and data sets interoperable as plug-and-play components is to describe their variables, grids, assumptions and modeling approaches with standardized metadata and to wrap them with noninvasive, standardized interfaces (i.e. APIs). Using standardized APIs tames model heterogeneity by acting as a sort of "universal remote control" for models. This project has demonstrated the incredible flexibility, portability, automation and ease-of-reuse that is made possible by standardized model control interfaces, allowing models to be moved between the modeling frameworks used by federal agencies and academic institutions. New technologies such as the Earth Science Framework Description Language, the Geoscience Standard Names ontology, and software adapters that allow a given model to be deployed in multiple model-coupling frameworks will be described. Several practical examples of Earth System Model interoperability made possible by these new technologies will also be described.