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Interoperability between the Basic Modeling Interface (BMI) and the Open Modeling Interface (OpenMI): A Step Toward Building the Earth System Bridge for Modeling Framework Interoperability

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Abstract: Interoperability among environmental modeling frameworks is important to allow for the exchange of software components for modeling, analysis, and data access between these systems. Modeling frameworks share the concept of encapsulating models as software components or services within a larger modeling framework where the components have defined interfaces and data exchange formats. However, the exact definition of these interfaces and data exchange formats differs across modeling frameworks. The Earth System Bridge project, funded by the US National Science Foundation (NSF) under their EarthCube program, seeks to address this challenge by adopting a core model component that can be wrapped using different interface standards and brought into modeling frameworks adopting that particular interface standard. If successful, the computation engines for models can be written once and then shared across modeling framework systems, reducing code duplication, creating authoritative versions of models, and providing a step toward more reproducible model results across modeling frameworks. The Basic Model Interface (BMI) is the proposed interface for building core modeling components within Earth System Bridge. Within the Earth System Bridge project, efforts are underway to provide interoperability between BMI components and a number of model interface standards and frameworks including the Earth System Modeling Framework (ESMF), the Object Modeling System (OMS), and the Open Modeling Interface (OpenMI). The focus of the research presented in this presentation is to provide interoperability between BMI and OpenMI. A mapping between the two interfaces is proposed along with a prototype implementation. There are many challenges in providing interoperability, both in terms of concept matching and technical implementation of the prototype system, that will be discussed. After exploring different potential solutions, model-as-a-service was determined to be the most promising means for providing interoperability across operating systems and programming languages used by BMI and OpenMI. A prototype system using the Google App Engine for exposing models as web services is presented as a way forward for creating authoritative models exposed using BMI and consumable by a variety of client applications including an OpenMI-compliant client application prototyped through this research.

Keywords: Integrated environmental modeling; model interoperability; modeling frameworks; BMI; OpenMI