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The Design of Distributed Model Integration Framework – DMIF

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Abstract

Integration of models requires linking of components, which may be developed by different teams, using different tools, methodologies, and assumptions. Participating models may operate at different temporal and spatial scales. We describe and discuss the design and prototype of the Distributed Model Integration Framework (DMIF) that links models, which can be deployed on different hardware and software platforms. Distributed computing and service-oriented software development approaches are utilized to address the different aspects of interoperability. Web services are used to enable technical interoperability between models. To illustrate its operation, we developed reusable web service wrappers for models developed in NetLogo and GAMS based modeling languages. We also demonstrated that some of semantic mediation tasks can be handled by using openly available ontologies, and that this technique helps to avoid significant amount of reinvention by different framework developers. We investigated automated semantic mapping of text-based input-output data and attribute names of components using direct semantic matching algorithms and using an openly available lexical database. We found that for short text-based input-output data and attribute names of components direct semantic matching algorithms work much better than applying a lexical database. This holds true for both standardized and non-standardized short text and this is mainly because short text does not include contextual information of data. Furthermore, direct semantic matching algorithms can be applied to search for components that can possibly provide data for a given component (1) if a model repository uses standard names for attributes of components and (2) if metadata of components are made available through an API. As a proof of concept we implemented our design to integrate climate-energy-economy models. Our design can be applied by different modeling groups to link a wide range of models, and it can improve the reusability of models by making them available on the web.