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Identification of model parameters in cloud deployed simulation service

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Description of Work

We exported several models in standard Modelica language as a FMI unit and integrated with the ServiceStack webservice framework to provide REST api. Each simulation web service registers itself into identification application which uses it to distribute the simulation tasks coming from identification algorithm - in our case customized genetic algorithm. The simulation web services were deployed in cloud provided by czech NGI CESNET - METACENTRUM and CERIT-SC. The estimated time of identification on complex model of human physiology [HumMod2011] was reduced from 71 days, where the computation was be done by 1 CPU, to 18 hours - computation on 100 CPU (10 virtual machines in cloud each with 10 CPU involved in model simulation).

[HumMod2011] Kofranek J., Matejak M., Privitzer P. HumMod-Large Scale Physiological Models in Modelica, Proceedings 8th Modelica Conference, Dresden, Germany, March 20-22, 2011, 713-724, Link¨oping Electronic Conference, Proceedings

Relevant URL (if any)

http://physiome.lf1.cuni.cz/identifikace/WebApp/GenericUIen.html

Printable Summary

Identification of parameters is a fundamental part of scientific work within physiology research. The methods to identify systems of complex model are usually based on some simplification and optimization which may deliver the results quickly, but usually some constraints must be followed otherwise these methods may lead to misinterpreted results. Brute-force methods, however, may take too long time and are used usually on small models. To identify parameters of complex models may be time consuming, however, some degree of parallelization can be achieved with optimization methods e.g. genetic algorithm.

We introduce a method where a simulation of a model is distributed into web services accessible via REST interface, each web service is deployed in cloud and can be cloned per request. So the combination of brute-force method with some optimization method can be used also in complex models and estimated time and continuous results can be seen during the computation.

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