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Virtual Research Environment "Optimal Engineering Design as a Service"

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Porting engineering applications to the grid and cloud platform can be based on the paradigm of Service-Oriented Computing (SOC) which utilizes services as the basic constructs to support the development of rapid, low-cost and easy composition of distributed applications even in heterogeneous environments.
It is proposed to develop the Services Repository (Platform Supporting Services and Application support services), from which a user will be able to composite his own design route in the particular engineering field.
The Platform Supporting Services offer the standard operations for service management and hosting (e.g. cloud hosting, event processing and management, mediation and data services, services composition and workflow, security, connectivity, messaging, storage etc.).
The Application support services are created by investigating the generalized engineering design process and selecting its loosely coupled stages and procedures for subsequent their transferring to the forms of standardized web-services. It is possible also to analyze the existing mathematical modeling and optimal design software for the possible re-use of the best algorithms and design procedures implementations in the creating the repository of Application support services.

Wider impact and conclusions

Solution in hand is designed primarily to meet the needs of small and medium enterprises in the modern toolkit design of complex technical objects and technological processes, as well as the small research laboratories to perform complex computational experiments. A long-term strategy for the Engineering Design is to create flexible networked simulation and modelling tools for "bottom-up"or "top-down/ bottom-up".

References

[1]. Petrenko A.I., V.Ladogubets, O. Finogenov, B. Bulakh. WebALLTED: Interdisciplinary Modelling in Grid and Cloud .-// Computer Science, AGH, Krakow, 14(2),2013, ISSN 1508-2806, pages 295-306.

URL(s) for further info

http://grid.kpi.ua/files/egi.petrenko.pdf

Description of work

To accelerate the process of applications porting the following research and development activities had to be conducted:
1). Investigating Engineering Design procedures as possible services in distributed environments instead of present attempts to migrate monolithic large CAE/CAD software systems into the grid/ cloud infrastructure as it is done in [1]. To get this it is necessary:
 to implement novel service-oriented design paradigm in Engineering according to which all levels of design including components, circuit and system levels are divided into separate loosely coupled stages and procedures for their subsequent transfer to the form of standardized web-services;
 to analyze the existing mathematical modeling and optimal design software for the possible re-use of the best algorithms and design procedures implementations in the creating the depository of applied web services;
 to develop a container with interfaces for standardized individual web-services based on international standards and protocols which allow building compositions from these web-services as design (calculations) workflows.
2). Comparing and integrating the procedure-oriented and resource-oriented services taking account their advantages and constraints and using Linked Data technology for combining Web services, RESTful services and Semantic Web-Services on the base of known SPARQL, RDF and other standards.
3). Re-engineering the existing service workflow tools for composition and orchestration of heterogeneous web-services into a user defined computing scenario or a Design route, which comprises a set of ontology,

domain-specific heuristics, and a knowledge base to support the semi-automatic workflow composition.
4) Developing a distributed web-services repository which provides the access to autonomous, platform-independent Design procedures of CAE / CAD tools.

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