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## Distributed Multiscale Computing: The MAPPER project

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### Overview

Today scientists and engineers are commonly faced with the challenge of modelling, predicting and controlling multiscale systems which cross scientific disciplines and where several processes acting at different scales coexist and interact. Such multidisciplinary multiscale models, when simulated in three dimensions, require large scale or even extreme scale computing capabilities. The MAPPER project develops computational strategies, software and services for distributed multiscale simulations across disciplines, exploiting existing and evolving European e-infrastructure.

### Impact

MAPPER is driven by seven exemplar applications from five user communities (virtual physiological human, computational biology, fusion, hydrological engineering, nano material science), and these communities are specifically targeted. However, our solutions are generic and will enable distributed multiscale computing for any multiscale model fitting into our paradigm, and MAPPER therefore opens up to other user communities as well.

MAPPER partners have significant trans-Atlantic grid and HPC experience, and have been involved very actively in TeraGrid and with the US Department of Energy laboratories. We collaborate with the US TeraGrid to integrate infrastructures across the globe.

### Description of the work

Driven by seven challenging applications from five representative scientific domains (fusion, clinical decision making, systems biology, nano science, engineering), MAPPER deploys a computational science environment for distributed multiscale computing on and across European e-infrastructures. By taking advantage of existing software and services, as delivered by EU and national projects, MAPPER will result in high quality components for today's e-infrastructures. We develop tools, software and services that permit loosely and tightly coupled multiscale computing in a user friendly and transparent way. We integrate our applications into the MAPPER environment, and demonstrate their enhanced capabilities.

MAPPER integrates heterogeneous infrastructures for programming and execution of multiscale simulations. We reuse as much of the existing infrastructural and software solutions as possible. The MAPPER solutions is developed on top of existing e-infrastructures without the necessity to modify already deployed components. The functionality to be delivered is realized as extensions to existing e-infra-structures. The integration is done using well defined APIs and standard based interfaces, thus reducing potential im-pact of changes on middle-ware level components.

## URL

[www.mapper-project.eu](http://www.mapper-project.eu)

## Conclusions

MAPPER started on October 1, 2010, and is now producing first results. It is expected that first demonstrations of Distributed Multiscale Computing will be available during the conference. MAPPER will quickly move forward, and it expects to be able to offer a first Distributed Multiscale Computing environment for external projects when entering its second project year.

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