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Vashra-T: Grid Ray Tracing for the Fusion Physics ASTRA Code

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The ASTRA code, which has been developed at Kurchatov Inst. and IPP-Garching, solves diffusion equations subject to magnetic fusion plasmas. This code is being run on a shared memory machine at CIEMAT, which makes it difficult to scale. To begin with, after analyzing the different external modules called by ASTRA, a Ray Tracing one was chosen for Grid execution. In this way, all jobs related to Ray Tracing will run onto the Grid, increasing their number and the module's level of parallelism.

Impact

This is a work in progress, but there are two main goals that will be achieved in the production system. The first one is about scaling the ASTRA+TRUBA set, providing access to a high number of Grid resources and allowing to increase them, so simulation results will be nearer to real conditions. The second one concerns Grid submission to different infrastructures from a code executed on a limited environment. The GridWay metascheduler has been chosen for its interoperability capabilities as the DMZ machine has Globus Toolkit 4 installed and the different middlewares found at the Grid infrastructures accessed: The Fusion VO from EGEE and EELA Projects, the CIEMAT local resources, and the GRIDIMadrid infrastructure. The first two infrastructures are built using the gLite middleware, but the last two are not. On one hand, CIEMAT local resources have Globus Toolkit Pre-WS installed; on the other, GRIDIMadrid machines rely on Globus Toolkit WS.

URL for further information

http://www.gridway.org/ - The GridWay Metascheduler

Conclusions and Future Work

Previous work has demonstrated that Ray Tracing can be executed efficiently on the Grid. Next efforts are focused on its integration with the ASTRA code in order to build a prototype version of Vashra-T. The knowledge acquired in this process will serve for delegating to the Grid other selected ASTRA modules.

Keywords

Fusion, Ray Tracing, ASTRA, TRUBA, GridWay, interoperability, Application Porting

Detailed analysis

Actual ASTRA executions take seconds but it is often required that different, computationally demanding modules are called from ASTRA. One such modules is TRUBA, a Ray Tracing code that calculates the trajectories and power deposition of a pre-set number of rays, in which the microwave beam shot inside the reactor is decomposed. Actual Ray Tracing is being done with 91 rays and the process is being called in several intervals. Each ray is traced in about 9 minutes on a Pentium 4. The aim is to increment the rays traced to 200, an impractical task in the current environment, as the process using just 91 rays takes about 4 or 5 days.
The Vashra-T framework, which consists in a set of scripts and machine configurations, is responsible of performing the Ray Tracing onto the Grid when asked by ASTRA. This involves the upload of input files to the

DMZ machine, calling the Grid execution using the GridWay metascheduler and retrieving the output files at the end.

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