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Supporting legacy code applications on EGEE VOs by GEMLCA and the P-GRADE portal

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Grid environments require special grid-enabled applications capable of utilising the underlying middleware services and infrastructures. Most Grid projects so far have either developed new applications from scratch, or significantly re-engineered existing ones in order to be run on their platforms. This practice is appropriate only in the context where the applications are mainly aimed at proving the concept of the underlying architecture. However, as Grids become stable and commonplace in both scientific and industrial settings, a demand will be created for porting a vast legacy of applications onto the new platform. Companies and institutions can ill afford to throw such applications away for the sake of a new technology, and there is a clear business imperative for them to be migrated onto the Grid with the least possible effort and cost.

Grid computing has reached the point where reliable infrastructures and core Grid services are available for various scientific communities. However, not even the EGEE Grid contains any tool to support the turning of legacy applications into Grid services that provide complex functions on top of the core Grid layer. The Grid Execution Management for Legacy Code Architecture (GEMLCA), presented in this paper, enables legacy code programs written in any source language (Fortran, C, Java, etc.) to be easily deployed on the EGEE Grid as a Grid service without significant user effort. GEMLCA does not require any modification of, or even access to, the original source code. A user-level understanding, describing the necessary input and output parameters and environmental values –such as the number of processors or the job manager required –is all that is needed to port the legacy application binary onto the Grid. Moreover, since GEMLCA has been integrated with the P-GRADE Portal, end-users can publish legacy applications as Grid services and can invoke legacy code services as a special kind of job (node) inside their workflows by an easy to use graphical portal interface.

The GEMLCA - P-GRADE Portal has been operating for the UK NGS community as a service since September 2005. Recently, the researchers of the University of Westminster and MTA SZTAKI have developed the EGEE-specific version of this tool. The EGEE-specific GEMLCA P-GRADE Portal offers the same legacy code management and workflow-oriented application development and execution facilities for EGEE research communities that have been provided on the UK NGS for more than six months now.

On top of the JSR-168 compliant portlets of the P-GRADE Portal (credential management, workflow enactment, etc) the GEMLCA-specific version contains an additional portlet that can be used to turn legacy applications into Grid services and to offer these services to other users of the portal. These users can invoke the legacy code services with their own custom input data, moreover, they can integrate legacy code services with newly developed codes inside their workflows. The portal environment contains a GEMLCA-specific editor to help users define such workflows. The workflow enactment service integrated into the Portal is capable to forward job submission and legacy code service invocation requests to appropriate providers. While the core EGEE sites are responsible for job execution,

the “legacy code repository”component of the portal server handles legacy code invocation requests.
This centralised repository provides opportunity for portal users to share applications with each other. The facility is a natural step to extend the concept of Virtual Organizations (VO). While the storage services of the EGEE Grid provide storage space for VO members in order to share data with each other, the code repository component of the GEMLCA P-GRADE Portal provides facility for VO members to share applications with each other. Moreover, since the P-GRADE Portal can be connected to multiple VOs at the same time, application sharing among the members of different VOs can take place through the Portal.
According to the current notion of EGEE the Grid is separated into research domain specific VOs, each of them containing relatively small number of resources. This concept simply prohibits two scientists working on two different scientific domains to collaborate with each other. Because these researchers are members of two different VOs there is no way for them to share applications with each other. However, by publishing their applications in the “legacy code repository”component of the GEMLCA P-GRADE Portal they can share these codes with other members of the whole EGEE community. This facility paves the way for revolutionary results in interdisciplinary research.

Besides the GEMLCA P-GRADE Portal the presentation will introduce an urban traffic simulation application developed on the EGEE Grid using this tool.
The traffic simulation is based on a workflow consisting of three types of components. The Manhattan legacy code (component 1) is an application to generate inputs for the MadCity simulator: a road network file and a turn file. The MadCity road network file is a sequence of numbers, representing a road topology of a road network. The MadCity turn file describes the junction manoeuvres available in a given road network. Traffic light details are also included in this file. MadCity (component 2) is a discrete-time microscopic traffic simulator that simulates traffic on a road network at the level of individual vehicles behaviour on roads and at junctions. After completing the simulation, a macroscopic trace file, representing the total dynamic behaviour of vehicles throughout the simulation run, is created. Finally a traffic density analyser (component 3) compares the traffic congestion of several runs of the simulator on a given network, with different initial road traffic conditions specified as input parameters. The component presents the results of the analysis graphically.
The lecture will use this application to describe how portal users can integrate their domain-specific applications into a large distributed program to solve the complex problem of traffic simulation. This example will present the benefits of portal-based collaborative work on the EGEE.

Summary

Integrating GEMLCA and the P-GRADE portal enables EGEE users to use their exisiting legacy codes as Grid services without writing any wrapper or modification for the existing legacy codes. More than that such legacy codes can be used as components of workflows, combining them into complex Grid applications. Furthermore, the integrated GEMLCA/P-GRADE portal enables the transformation of any executed Grid job into a legacy service that can be easily used by other members of the VO community.

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