GT4Tray: A Tool to Realize Dynamic Grid Infrastructures Based on Web Services

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***Abstract*— This proposal presents GT4Tray, a tool which operates on top of a standard Globus Toolkit 4 Java Web Service Core to allow easy administration of WSRF–compliant Web services. In addition to a graphical user interface, GT4Tray provides a set of convenient Web services to support dynamic deployment and extensive monitoring capabilities.**

I. Motivation

The standard Globus Toolkit 4 WS–Core [1] contains a Web service container for hosting WSRF–compliant Web services [2]. An infrastructure consisting of Globus Web service containers is static; changes, e.g. deploying new Web services, require a container restart. Furthermore, there is no mechanism for detailed monitoring to decide which container is currently most suitable for computations. Consequently, the following features are required:

- dynamic deployment allowing to deploy or update services without interfering with other running services or the underlying infrastructure;
- live monitoring for scheduling purposes to optimize load, efficiency and response times;
- a graphical user interface to access deployment and monitoring information on local as well as on remote machines to ease administration.

These features allow to realize a Grid infrastructure which can be extended easily and dynamically, either by dedicated servers or even by standard desktop computers running arbitrary operating systems.

II. Contribution

GT4Tray is realized to be fully platform independent. To offer the ability to deploy Web services dynamically, the Hot Deployment Service (HDS), provided by the University of Marburg, is utilized [3]. Unlike any other deployment mechanism provided by the Globus Toolkit, it allows the deployment of new Web services without interfering with running instances of other services. Thus, the HDS enables a demand–driven expansion of a Grid infrastructure to allow large–scale parallel executions of WSRF–compliant Web services on demand.

For scheduling decisions, a Performance Measurement Service is introduced. It collects information about the CPU usage and the general configuration of a machine, such as e.g. the Java version or available disk space. Furthermore, the default mechanism to monitor Web services, the Monitoring and Discovery System of the Globus Toolkit, is included.

All these features are accessible by an intuitive graphical user interface. Thus, they are realized itself as WSRF–compliant Web services, and remotely running instances of GT4Tray can be administrated and monitored without additional effort. The user interface can be minimized to the background, e.g. to the systray, if running under Windows systems.

If it is desired to make the underlying Web service container available in a production environment, it can be smoothly uncoupled from the graphical interface by running in a headless–mode without a graphical frontend.

III. Results

For testing purposes, a Web service for image registration, using the free Java image processing library ImageJ [4], was implemented. The application focuses on CPU usage with a moderate amount of data communication for image transfer and service deployment. The infrastructure was set up by installing GT4Tray on 8 standard desktop machines running Windows and Linux. With this heterogeneous configuration, a speedup between 3 and 5, in comparison to stand–alone execution, could be reached, depending on the number of involved machines. The processing time was dominated by the slowest machine. To eliminate this side–effect, a homogeneous infrastructure consisting of 16 Linux machines running GT4Tray was installed. In this environment, a speedup of about 6.5 was reached using 8 machines. Involving all 16 machines, the speedup was about 10, compared to the execution on a single machine.

References

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