

eServices Infrastructure for Collaborative Science

Principal Investigators:

Katarzyna Keahey, ANL

Keith Jackson, LBNL

Summary

The eServices Infrastructure for Collaborative Science Project is developing technology and services designed to address the needs of the Science and Technology Computing (STC) community in the context of the Open Grid Services Architecture (OGSA). By providing a unifying standards-based architecture for computational Grids, OGSA leads to the development of next generation Grids. This project supports this movement by contributing towards developing general OGSA infrastructure and developing higher-level services. Our main focus however is to make OGSA accessible to scientific applications. We therefore investigate performance issues, develop language bindings needed by the STC community such as C, Python, and C++, and develop application-level services and functionality.

The Open Grid Services Architecture (OGSA) is a milestone in the evolution of computational “Grids”: systems allowing for flexible, secure, and coordinated resource sharing among dynamic collections of individuals and institutions. It represents an evolution of the current Grid technologies leading towards a Grid system architecture based on an integration of Grid and Web services concepts and technologies. A standard technology base allows us to provide a unifying framework for the description, discovery, and invocation of services in the Grid. Conversely, it also allows technologies developed within the Grid community to provide added value to Web services, by addressing federation, security, reliable invocation, and lifetime/state management issues not supported by current Web services technologies. Thus, the advantages of the framework, flow in two directions: developers of collaboratory applications gain access to emerging Web services technologies while at the same time, the industrial Web services community gains access to the advanced technologies

developed by the Grid community.

From the perspective of Grid users providing a unifying architecture for the Grid significantly lowers the entry barrier and development costs of building collaborative, distributed applications. It enables service developers to rely on well-defined standards in order to provide their services, and it enables users to access these services in standard ways. This enhances the collaborative work paradigm through opening the doors for new inter-collaboratory relationships. For this reason, we believe that this effort stands to be of critical importance to the widespread acceptance of Grids.

OGSA addresses the needs and challenges prevalent in both e-business and e-science. While these two communities share a common vision, and a common base in terms of needs related to Grid computing, they also face challenges unique to their specific needs. This project is dedicated specifically to investigating and satisfying the unique needs arising in the context of Scientific and Technical Computing (STC).

In addition to ensuring that the needs of STC community are reflected in OGSA standards, we also provide implementations of the Open Grid Services Infrastructure (OGSI) using tools and languages that the scientific community relies on, such as C/C++ and Python. We will investigate performance issues of critical importance to STC; our focus here is on communication protocols and optimal infrastructure implementation. Finally, we invest in application-level infrastructures and services development to make the Grids easily accessible to application scientists. A thrust in higher-level services development allows us to support and bind these efforts.

The current research and development efforts focus primarily on producing efficient and reliable implementations of OGSI. Based on community feedback, and in order to facilitate transitions for established user communities we also initiated efforts providing backwards compatibility with previously existing Grid infrastructures. Accordingly, although less than a year in existence, this project has already contributed the C client side implementation of OGSI, allowing for secure interactions, and fully compatible with existing implementations of OGSI servers. In addition, we provided the Globus Toolkit GRAM client interface, familiar to many Grid users, implemented on the base of these bindings. This code has been made accessible to the community as part of the Globus Toolkit 3 (GT3) alpha release. Similarly, we developed a Python client side implementation of OGSI, with full support for secure interactions, and demonstrated its compatibility with OGSI servers released as part of GT3 alpha release. This required the development of standard tools in Python for parsing Grid Service Definition Language (GSDL) files, and its integration into the standard Python web service toolkits. In

addition we are implementing elements of the Web Service Security standards to allow for the usage of message level security. This is important to allow compatibility with the ongoing security work in OGSA and the commercial web service community. For both the C and Python efforts, we initiated design and planning leading to the development of server side functionality. This will allow the development of OGSI services in C/C++ and Python that can leverage off the sophisticated security, lifecycle management, and notification services that are an integral part of the OGSA standard. It will also be of vital importance to allowing legacy scientific codes to be exposed to the Grid as OGSI components. Working with the SciDAC National Fusion Collaboratory project we also initiated work on application services that should be of broad interest to the STC application community..

In the next years, we plan to continue our efforts in OGSI implementation. We will broaden our original focus on C and Python to include C++. We also plan to start thrusts investigating the performance of protocol bindings for OGSA, develop further application-related research, and define and implement STC higher-level services.

For further information on this subject contact:

Kate Keahey, PI
Argonne National Laboratory
<http://www.mcs.anl.gov/eservices>
Phone: 630-252-1673
keahey@mcs.anl.gov