Grid Computing Environments Community Practice (CP) Document

Project Title: DISCOVER: An Interactive Computation Collaboratory for Grid Applications
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Project URL(s): www.discoverportal.org
www.caip.rutgers.edu/TASSL/Projects/DISCOVER

1. Overview

A. Description & Goals:

DISCOVER (*D*istributed *I*nteractive *S*teering and *Co*llaborative *V*isualization *E*nvi*R*onment) is an interactive and collaborative PSE that enables geographically distributed scientists and engineers to collaboratively monitor, and control parallel/distributed applications using web-based portals. Its primary objective is to transform grid applications into true research and instructional modalities.

B. Services provided:

DISCOVER enables geographically distributed members of virtual organizations to collaboratively monitor, interact with and steer distributed applications in a secure and authorized manner using web-based portals.

C. Systems/Sites/User Served:

DISCOVER services are available at www.discoverportal.org. Application, once registered, can utilize DISCOVER services.

D. Status:

DISCOVER is currently operational at www.discoverportal.org and being used to provide interaction capabilities to a number of scientific and engineering applications, including oil reservoir simulations, computational fluid dynamics and numerical relativity.

2. Architecture

An architectural overview of the DISCOVER collaboratory is presented in Figure 1. DISCOVER supports a 3-tier architecture. Its front-end is composed of detachable client portals. Clients can connect to a DISCOVER server at any time using a browser to receive information about active applications. Furthermore, they can form or join collaboration groups and can (collaboratively) interact with one or more applications based on their capabilities. A network of interaction and collaboration servers forms the middle tier. These servers extend web-servers with interaction and collaboration capabilities. Each server is independently implemented and administered, and a client can access the most "convenient" server and have access to all (local and remote) applications to which it has access privileges. The underlying DISCOVER security architecture ensures authorized and secure access. The back-end consists of control network composed of sensors, actuators and interaction agents. The DISCOVER interaction model is application initiated, i.e. the application registers with a server, exporting its interaction interface. The interaction interfaces are defined and exported using high-level abstractions. Views encapsulate sensors and provide information about the application and the application objects, while commands encapsulate actuators and process steering requests. Some or all of these views/commands may be collaboratively accessed by groups of clients based on the clients' capabilities.

A. Define Grid software/services that the GCE currently depends upon and relationship to GF Working Group:

The current deployment of DISCOVER is built on extensions of commodity distributed computing technologies and does not directly use Grid software/services.

B. Define Grid software/services that the GCE plans to make use of:

DISCOVER is currently being extended to use the grid security and information services. It is also being integrated with the CoG Kit using a CORBA bridge.

C. Define Grid software/services that are needed by the GCE but are not supported by the Grid:

D. Define software/services used/needed by the GCE that are outside the scope the Grid:

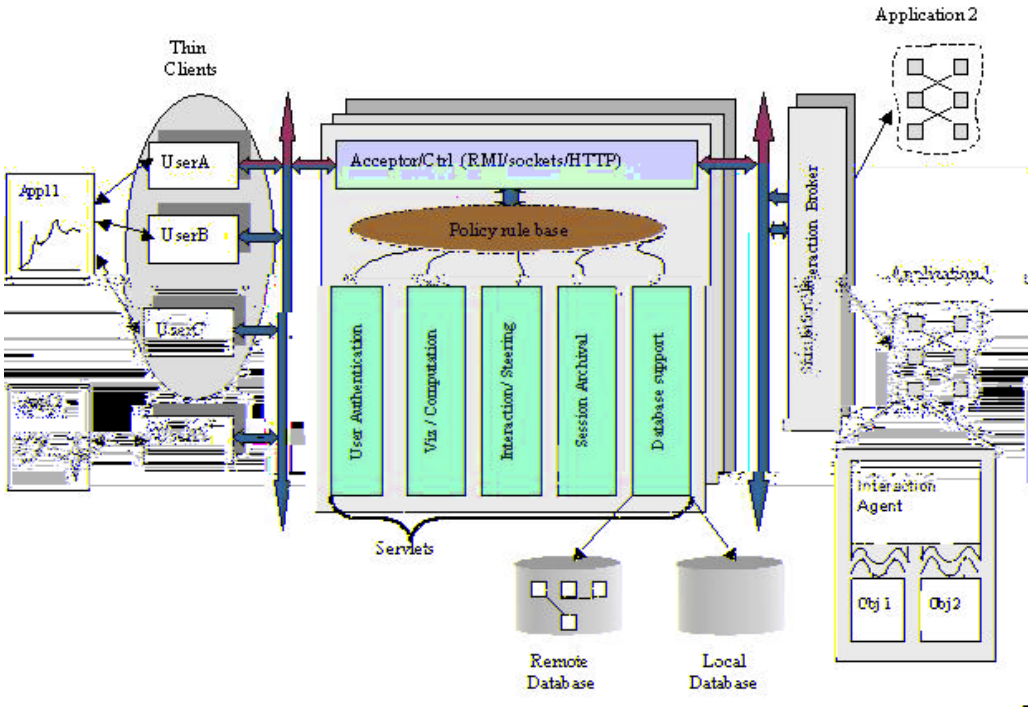

Figure 1 - An Architectural Overview of DISCOVER

3. Implementation

The DISCOVER interaction servers build on servlet technology and enable clients to connect to, and collaboratively interact with registered applications using a conventional browser. Geographically distributed serves are interconnected using CORBA. CORBA trader services are used to discover available DISCOVER servers. Servers share a common IDL, and a server can invoke methods defined by this IDL on a remote server reference. This enables clients to access applications connected to a remote server if they have appropriate access privileges. The application control network is built on the MPI messaging infrastructure and enables sensors and actuators to be encapsulated within, and directly deployed with the computational objects. Interaction agents resident at each computational node register the interaction objects and export their interaction interfaces. The application interaction gateway manages the overall interaction through the control network of interaction agents and objects. It uses the Java Native Interface to create Java proxy objects that mirror the computational objects and allow them to be directly accessed by the interaction web-server. Security and authentication services are provided using customizable access control lists built on the SSL-based secure server. All application information is encrypted and includes a MD5 signature that is encoded using a private key.

A. Commodity technologies/software used (e.g., EJB, JMS, JINI, Perl, XML, databases…)

Commodity technology currently used by DISCOVER include:

Portal: Java, Php DHTML

Interaction/Collaboration Servers: Servlets, CORBA, IIOP, Java RMI, MySQL, SSL, PKI, MD5

Application Control Network: MPI, JNI, Java RMI

B. Proprietary technologies/software developed that can be shared with others:

None.

4. Supported Grid Services

A. Security:

Yes (see above)

B. Information services:

C. Scheduling:

D. Data transfer:

D. Additional Grid services:

E. Other:

DISCOVER provides collaboration, monitoring, interactive steering services for grid applications. It provides support for defining, deploying and accessing sensors and actuators within distributed and dynamic application objects.

5. Project Status and Future Plans

DISCOVER is currently operational and provides collaborative interaction and steering capabilities to scientific and engineering simulations, including oil reservoir simulations, computational fluid dynamics and numerical relativity. DISCOVER is currently being extended to use the grid information and security services. The DISCOVER server network is being expanded to include deployments at CSM, University of Texas at Austin, and CACR, California Institute of Technology. Finally, a CORBA bridge is being implemented to enable services provided by the Java CoG Kit to be combined with DISCOVER.

6. References

1. DISCOVER Computation Collaboratory – www. discoverportal.org.
2. "Java Native Interface Specification," http://web2.java.sun.com/products/jdk/1.1/docs/guide/jni.
3. J. Hunter. "Java Servlet Programming," 1st edition, O'Reilly, California (1998).
4. "CORBA: Common Object Request Broker Architecture," http://www.omg.org.
5. "Java Remote Method Invocation," http://java.sun.com/products/jdk/rmi..
6. MPI Forum. "MPI: Message Passing Interface," http://www.mcs.anl.gov/mpi.
7. "PHP Hyper Processor," http://www.php.net.
8. "MySQL," http://www.mysql.com.
9. "Myproxy (v 1.0)," National Laboratory for Applied Network Research, http://dast.nlanr.net/Features/MyProxy/.
10. Java CoG Kit, http://www.globus.org/CoG.
11. Using DISCOVER to build Interactive and collaborative reservoir simulations, http://www.ticam.utexas.edu/~ut/webipars/.