

# Open Grid Computing Environments (OGCE) Annual Report: September 1, 2003-August 31, 2007

Open Grid Computing Environments (OGCE) Annual Report: September 1, 2003-August 31, 2007.....	1
1. Project Overview .....	3
1.1. Overview.....	3
1.2. Highlights and Major Contributions .....	3
1.3. Participants.....	4
1.3.1. University of Chicago .....	4
1.3.2. Indiana University.....	4
1.3.3. University of Michigan.....	5
1.3.4. National Center for Supercomputing Applications.....	5
1.3.5. San Diego State University .....	6
1.3.6. Texas Advanced Computing Center .....	6
1.4. Project Organization .....	6
2. Year 1 (2003-2004) Project Overview.....	7
2.1. Outreach Deliverables.....	7
2.2. Open Grid Computing Environments Collaboratory .....	8
2.3. Grid Portal Consortium Toolkit Deliverables.....	9
2.3.1. Initial Delivery Set (November 2003) .....	9
2.3.2. Second Delivery Set (May 2004).....	10
2.4. Programmatic/Managerial Deliverables .....	11
3. Year 2 (2004-2005) Overview and Highlights .....	12
3.1. Sample Application Portal Projects .....	14
3.2. Collaborations .....	17
3.3. Activities and Findings .....	18
3.3.1. Summary of Activities .....	18
3.3.2. Supporting Collaborative Communities .....	19
3.3.3. Global Software Deliverables.....	20
3.3.4. Indiana University Local Deliverables .....	22
3.3.5. University of Chicago Local Deliverables.....	24
3.3.6. SDSU Local Deliverables .....	26
3.3.7. TACC Local Deliverables.....	27
3.3.8. NCSA Local Deliverables.....	29
3.3.9. University of Michigan Local Deliverables.....	29
3.3.10. Outreach Deliverables.....	31
3.4. Products, Software, and Web Sites .....	34
3.5. Training and Outreach .....	34
3.6. Publications.....	35
3.6.1. Presentations and Posters .....	35
3.6.2. Book Chapters.....	37
3.6.3. Conference Publications .....	37
3.6.4. Journal Publications and Technical Reports .....	38
3.6.5. Posters .....	39

4.	Year 3 (2005-2006) Project Overview and Highlights .....	39
4.1.	Collaborations .....	46
4.2.	Activities and Findings .....	46
4.2.1.	Supporting Collaborative Communities .....	46
4.3.	Deliverables .....	46
4.3.1.	Project-Wide Software Deliverables.....	46
4.3.2.	Project Wide Technical Outreach Deliverables.....	48
4.3.3.	University of Chicago Deliverables.....	51
4.3.4.	Indiana Deliverables .....	52
4.3.5.	University of Michigan Deliverables.....	53
4.3.6.	NCSA Deliverables.....	55
4.3.7.	San Diego State University Deliverables.....	55
4.3.8.	Texas Advanced Computing Center Deliverables.....	56
4.3.9.	Community Service and Outreach Deliverables.....	57
4.4.	Products, Software, and Websites.....	58
4.4.1.	OGCE2 Portal .....	58
4.4.2.	Tupelo Metadata Services Releases.....	58
4.4.3.	PURSe Portlets Release 1.0 .....	59
4.4.4.	GPIR 1.2.2 Release .....	59
4.4.5.	OGCE Web Site Revision.....	59
4.5.	Training and Outreach .....	59
4.6.	2005-2006 Publications and Presentations .....	60
4.6.1.	Presentations and Posters.....	60
4.6.2.	Books and Book Chapters.....	62
4.6.3.	Conference Publications (In chronological order).....	62
4.6.4.	Journal Publications and Technical Reports .....	64
5.	Year 4 (2006-2007) Project Summary and Highlights .....	65
5.1.	Collaborations and Support for Portal Developers .....	65
5.2.	Activities and Findings .....	65
5.2.1.	University of Michigan Deliverables: Sakai JSR 168 Support.....	66
5.2.2.	San Diego State University Deliverables.....	66
5.2.3.	NCSA Deliverables.....	67
5.2.4.	Indiana University Deliverables .....	67
5.2.5.	Science Portal Community Leadership: GCE Workshops .....	68
5.3.	Products, Software, and Web Sites .....	68
5.4.	Training and Outreach .....	68
5.5.	Publications.....	69
5.5.1.	Presentations and Posters.....	69
5.5.2.	Book Chapters.....	70
5.5.3.	Conference Publications .....	70
5.5.4.	Journal Publications and Technical Reports .....	71

# 1. Project Overview

## 1.1. Overview

The Open Grid Computing Environments (OGCE) project consists of the following core constituent areas for developing powerful, Web-based Science Gateways to Grid resources such as the NSF TeraGrid.

- Development of interoperable, standards-based Web components (portlets) for Grid computing.
- Grid client programming libraries and tools development.
- Development of Web Services to support Grid portals' information, metadata, and job execution and management requirements.

We develop, package, and release software for each of these component areas to enable Science Gateways and Grid portals to be easily built out of reusable, reliable software. We furthermore foster a community of users and developers through workshops, tutorials, courses, and development assistance. Finally, we track technology developments that will be the foundations for the next generation of Web portals.

## 1.2. Highlights and Major Contributions

The OGCE project has several major accomplishments and contributions to the field of Science Gateways and Grid Portals. We highlight these below. More detailed discussion are in the main body of the report.

- **OGCE Grid Portal:** We provide an “out of the box” Grid portal software package that contains all software a developer needs to create a simple Grid portal with clients to Globus GridFTP, GRAM, the Grid Portal Information Repository, Condor, Condor-G, and MyProxy.
- **Grid Programming Interfaces and Abstraction Layers:** We have developed a portal-compatible version of the Java CoG Kit that provides an extensible, high level programming abstraction layer to several Grid toolkits. The COG abstractions notably provide dynamic (runtime) binding to several different versions of the Globus toolkit services. We use the COG API to develop the OGCE portlets.
- **Sakai Support for Standard Portlets:** The Sakai Learning Management and Collaboration system, through OGCE funding, has added support for the JSR 168 portlet standard. This is based on the Apache Pluto 1.1 portlet container, which will also serve as the reference implementation for future versions of the portlet standard.
- **TeraGrid Production Deployment of GPIR:** The OGCE Grid Portal Information Repository (GPIR) Web Service and portlet (both included in the OGCE download) are both used by the TeraGrid as production Web components.
- **Portlet Development:** We provide several tools for developing portals and portlets. Highlights include our Velocity portlet bridge, which provides a way to convert Web applications developed using Apache Velocity into portlet components; Grid Tag Libraries and Beans (GTLAB), a set of Java Server Faces extensions that simplify the composition of Grid portlets using XML tags; and a container-independent solution to the inter-portlet communication that has been adopted by other portal developers.
- **Community Leadership:** Finally, we provide community leadership, most notably through the organization of the Grid Computing Environments workshops at

Supercomputing 2005-2007. These will be extended in our follow-on OCI-funded project. These workshops give the community a forum for presenting peer-reviewed short papers on their work.

### 1.3. Participants

The following participants have worked on the project during its four-year duration.

#### 1.3.1. University of Chicago

Participant	Role	Responsibilities
Gregor von Laszewski	Principal Investigator	Management of the portion of the project conducted at University of Chicago. He lead the development of the Java CoG Kit and designed significant changes to its core components in order to foster the needs of OGCE. He helped on the outreach to groups within ANL and also within the GGF where he was presenting OGCE related activities at the last three GGF.
Mihael Hategan	Developer	Development of the components to interface the Java CoG Kit with multiple Globus toolkit versions. In all this reduced significantly the amount of time others had to spend because adaptations to new Globus Toolkit versions.

#### 1.3.2. Indiana University

Participant	Role	Responsibilities
Marlon Pierce	Principal Investigator	Project management, velocity portlet development, portal build and test framework development.
Dennis Gannon	Co-Investigator	Advanced portal and service design for science application support (see deliverables), TeraGrid and LEAD project liaison, GGF steering committee membership,
Geoffrey Fox	Co-Investigator	Outreach, collaboration technologies, participation in GGF and UK e-Science steering committees.
Beth Plale	Co-Investigator	Data services and portlet development
Sunghoon Ko	Developer	GlobalMMCS Portlet development, portal services development.
Marcus Christie	Developer	Velocity portlet and tool development,

		unit test development, maven integration.
Sangmi Lee	Developer	LEAD OGSA-DAI user interface development
Mehmet Nacar	Developer	Java Server Faces development, Globus administration, portal testing
Gopi Kandaswamy	Grad Research Asst..	Application Factory Service (GFAC)
Liang Fang	Grad Research Asst.	Security Portlets
Yin Hao	Developer	CIMA portlet/portal development

### 1.3.3. University of Michigan

Participant	Role	Responsibilities
Charles Severance	Principal Investigator	Project management. Coordination between uPortal, Sakai, NEES, and OGCE. High level design and architecture.
Joseph Hardin	Co-investigator	Research applications of Sakai.
Beth Kirschner	Developer	Liaison to the NEES project for OGCE. Primary developer and lead for Sakai WSRP activity.

### 1.3.4. National Center for Supercomputing Applications

Participant	Role	Responsibilities
Jay Alameda	Principal Investigator	Project management, TeraGrid liaison, LEAD liaison, CORE NCSA liaison
Joe Futrelle	Co-Investigator	Project management, Tupelo development, science community engagement, NEES engagement. Tupelo is a generalization of the NEESGrid metadata system.
Joel Plutchak	Developer	Tupelo development
Shawn Hampton	Developer	Developer and maintainer of Trebuchet desktop file management tool, desktop development frameworks, service architecture
Albert L. Rossi	Developer	Developer and maintainer of Open GCE Runtime Engine (OGRE), service architecture, maven, NCSA tools and NCSA notification systems
Greg Daues	Developer	Science community engagement, portlet-OGRE integration, portlet development

### 1.3.5. San Diego State University

Participant	Role	Responsibilities
Mary Thomas	Principal Investigator	Project Management; developer of Portlets, and WSRF services; taught grid computing classes; portlet architecture research (AJAX); python portal framework investigations
Rob Edwards	CS Faculty	TeraGrid Open Life Sciences Gateway, Bioinformatics and web services
Ray Regno	Developer	Developer and maintainer of SRB Portlets; portlet architecture research (AJAX, CSS/Style)
Chongyang Zhao	Student Intern	Installation and testing of uPortal/GridSphere/GridPort
Henry Chan	Student Intern	Installation and testing of uPortal/GridSphere/GridPort
Tarun Bansal	Graduate Student	Developer and maintainer of SRB Portlets; portlet architecture research (AJAX, CSS/Style)
David Thomas	Graduate Student	Installation and testing of uPortal/GridSphere/GridPort

### 1.3.6. Texas Advanced Computing Center

Participant	Role	Responsibilities
Jay Boisseau	Co-investigator	Project Management
Eric Roberts	Developer	Velocity and JSP Portlet development, portal security development, TeraGrid User Portal lead/liaison, maven, JMeter performance tests; GridPort project manager
Akhil Seth	Developer	Velocity and JSP Portlet development, maven; SRB portlet work
Maytal Dahan	Developer	Velocity and JSP Portlet development, maven plugin development, performance and quality testing, GridPort project developer, TeraGrid portal developer

## 1.4. Project Organization

The OGCE members hold regular (weekly or bi-weekly) teleconferences and have frequent meetings at Global/Open Grid Forum and Supercomputing. We maintain a project website, <http://www.collab-ogce.org>, that links project information and software downloads. We maintain two mailing lists: [internal@ogce.org](mailto:internal@ogce.org) and [discuss@ogce.org](mailto:discuss@ogce.org) for communications with developers and users. Our CVS code base and mailing lists were maintained by Argonne

National Laboratory. The OGCE was approved as a dev.globus proto-project. However, we found the facilities and services of SourceForge to be preferable and so have moved the SVN project code repository and Bugzilla here. The SourceForge page is <http://sourceforge.net/projects/ogce>, which has links to bug reporting, SVN, and other information. Note we do not use SourceForge for official releases.

We utilize the following abbreviations for institutions and participants:

- IU: University of IU, Extreme Computing Labs, Community Grids Lab
- UC: University of Chicago, Argonne National Labs
- UI: University of Illinois, National Center for Supercomputing Applications
- UM: University of Michigan, CHEF Project
- UT: Texas Advanced Computing Center

## 2. Year 1 (2003-2004) Project Overview

Our primary activity in Year 1 was the development and release of the initial OGCE portal, based on the University of Michigan's CHEF project (which was in turn derived from Apache Jetspeed). A more detailed discussion of this year's deliverables and activities is below.

The Consortium divided its deliverables into the following categories:

1. Provide Outreach Deliverables: advertise our project and its goals through presentations and publications that are delivered to the Grid portal community.
2. Deploy Collaboratory Portal: create a project web site and other collaboration tools for internal project communications
3. Release Portal Building Toolkit: provide downloadable and easily installable Grid portal software.
4. Manage the Project: provide programmatic deliverables and management framework.

We now review each of these areas in more detail.

### 2.1. Outreach Deliverables

The project goal (from the proposal) is indicated with italic font.

1. *Participation in UK e-Science Grid in Edinburgh, Scotland (July 2004)*. The following OGCE projects were represented:
  - D. Gannon (IU) "The IU Alliance Portal and the Plan for OGCE"
  - C. Severance (UM.) "NEESGrid, CHEF and the Grid"
  - E. Roberts (UT) "HotPage Portlet Development at UT"
  - T. Urban (UT) "GridPort 3.0 Plans"
  - T. Urban (UT) "The Grid Portal Information Repository (GPIR) System."
  - G. Fox and M. Pierce (IU) "Portal Components for Distributed Collaboration"
2. *Work within the GGF to develop an Open GCE set of best practices*. The following GGF Informational Document was produced:
  - G. Fox, M. Pierce, D. Gannon, M. Thomas, "An Overview of Grid Computing Environments," Global Grid Forum GFD-I.9. <http://www.gridforum.org/documents/GFD>, 2003.

3. *Co-author GGF/GCE white paper surveying current best portal practices and makes recommendations to the community.* The following GGF Informational Document was produced:
  - D. Gannon, G. Fox, M. Pierce, B. Plale, G. von Laszewski, C. Severance, J. Hardin, J. Alameda, M. Thomas, J. Boisseau, "Grid Portals: A Scientist's Access Point for Grid Services (DRAFT1)", bibl. GGF informational paper., (2003). *GGF Informational paper.* Submitted as a GGF informational paper.
4. *We will work closely with GridLab and other teams on the above white paper through the GCE.* Several members of the OGCE attended GGF meetings and contributed in workshops that produced the Outreach deliverables described above. In addition teams at UT, UM, and IU have installed and tested the GridLab software.

## **2.2. Open Grid Computing Environments Collaboratory**

The goal of this set of deliverables was to establish the online resources to enable our internal project communications, to establish a Web presence, and to establish a community. The project met and exceeded all deliverable expectations in this category including delivering 3 additional outcomes/deliverables. Goals are in italics.

1. *Stand up an initial OGCE web site. This will be based on the CHEF version of Jetspeed with basic functional extensions derived from the Alliance Portal. The initial site's primary purpose will be to provide information about the project.* The initial collaboratory system was deployed at Argonne National labs for SC03. The collaboratory site was subsequently moved to IU servers mid-year due to Argonne National Labs security challenges. UC continues to maintain public and internal mailing lists for the project.
2. *Analyze possible community solutions, analyze interoperability. Produce a whitepaper (1 month).* The following GGF Informational Document was produced:
  - D. Gannon, G. Fox, M. Pierce, B. Plale, G. von Laszewski, C. Severance, J. Hardin, J. Alameda, M. Thomas, J. Boisseau, "Grid Portals: A Scientist's Access Point for Grid Services (DRAFT 1)", bibl. GGF informational paper., (2003). *GGF informational paper.* Submitted as a GGF informational paper.
3. *Implement a repository based on the requirements.* The OGCE CVS code repository was initially deployed at Argonne. The project has subsequently moved to SVN for code version management.
4. *Initial deployment of the repository and monitor stability.* The initial collaboratory system deployed at Argonne National labs by end of September, 2003.
5. *Evaluate deployment and iteratively correct.* Because of difficult installation policies at UC, the demonstration collaboratory was run by Indiana University. This collaboratory is built from OGCE software and serves as a demonstration of our system: <http://www.collab-ogce.org>. UC supports this effort remotely.
6. *Upgrade functionality of OGCE software to include demonstration capabilities of April Toolkit deliverables.* The OGCE Portal is based on most current OGCE release (See Deliverable 3 below).
7. *Additional Outcomes*
  - Portlet Information: the OGCE project reorganized the website to include snapshots and information about each portlet.
  - Portlet configuration metadata: added portlet configuration data that supports the

download of different toolkit versions.

- OGCE Portal Services: The OGCE portal download is configured to run with a number of default remote services. Several default services are provided for clients to use as part of their development and testing cycles. The list included GPIR, OGRE, and XML Newsgroups. In subsequent releases we focused on GPIR information systems (see Year 2-4).

## **2.3. Grid Portal Consortium Toolkit Deliverables**

This deliverable set focused on the development and release of Grid portal software. Efforts included portal packaging for easy installation.

### **2.3.1. Initial Delivery Set (November 2003)**

- Basic Portal Capabilities: Supercomputing 2003 Beta release. The beta release utilized the CHEF Framework from NEESGrid project, which is Jetspeed 1.
- Standard Jetspeed capabilities for configuration, customization. CHEF Framework utilizes these features. In addition, modifications to the login process allow the OGCE toolkit to use a GSI authentication session proxy for the lifetime of the session (UM, UT).
- MyProxy-based secure authentication: The portal uses GSI authentication with a portlet that pulls a proxy from a MyProxy server. (IU)
- Individual and group portal capabilities (teamlets). Collaboration Portal Services and User Interfaces (UM and IU)
  - Discussion boards, Discussion boards, announcements, chat and announcements, chat and instant messaging (UM) messaging portlets, calendar tools. These were delivered by UM along with the Chef 1.0.7 framework that we used as the portal container. These use an internal (to the portal) event system. This release also includes basic group sharing capabilities for these tools and the ability to create group spaces in the portal.
  - Calendar tools (UM)
  - Newsgroups and shared citation/reference management (IU) Newsgroup and citation browser portlets, developed and integrated by IU. These were coupled to external services that are included in a supplemental release.
  - Event-based communication services (UM, IU) Collaborative tools use an internal event system (IU, UM)
- Remote File Management Interfaces and Services (UM, IU, UT). Both the GridPort Toolkit and the Java CoG toolkit provide middleware services and APIs that the portlets can utilize. These toolkits provide bridges to remote services such as Globus Toolkit version 2 and version 3. (UC, UT).
- Grid information and monitoring services browsing portlets (IU, UT) for accessing GRIS/GIIS. Grid Information and Monitoring services, including LDAP/GRIS/GIIS portlet interfaces (IU) and GPIR v0.9 portlet interfaces (UT).
- Portlet interface to MyProxy through Java CoG, supplementing initial login (UC, IU). COG developments during this period included an upgrade of the security libraries.
- Portlet interfaces to GridFTP through Java CoG for remote file management (UC, IU, UT). Remote file management portlets: these included the GridFTP interface of IU and the WebDAV-based document system of UM. The UT GridFTP portlet was deemed to be

redundant with the IU interface, so UT focused on additional deliverables (below).

- Initial Grid Portal Information Repository software (UT). The GPIR initial release (GPIR 0.9) points to UT resources for demonstration in this release. Full GPIR support was included in the May 2003 release.

### 2.3.2. Second Delivery Set (May 2004)

- Application Manager Web Service (AMWS): this a dynamically launched workflow engine for managing complex scientific jobs. NCSA developed the Open Grid Run-time Environment (OGRE) workflow system. This was renamed from the Application Manager Web Service in the cooperative agreement. The OGRE system is available for download and extensively documented as part of this deliverable.
- Sample application to demonstrate AMWS capabilities, including input file staging, batch job execution, and result archiving OGRE client portlets and a sample application for interacting with the NCSA OGRE system for managing applications. Deployed to the Modeling Environments for Atmospheric Discovery (MEAD) (Alliance Expedition, leads Bob Wilhelmson and Sara Graves) and Linked Environments for Atmospheric Discovery (LEAD) (ITR, lead Kelvin Droegemier) Projects.
- Science application tools with user interface portlets. Toolset will IU developed interfaces to the XDirectory system, called GridContext in this portal release (IU). XDirectory server side was packaged as a separate download and is available through the OGCE website. The GridContext system, in addition to serving as a general purpose notebook, acts as an interface to the application factory services, allowing users to launch jobs, browse results posted via XEvents, and interact with applets. This deliverable was actually included in the SC release.
- Sample earthquake simulation code portlets (IU) The sample earthquake simulation portlets were replaced with a more generalized application wizard in the May version (IU). IU worked with NCSA to provide an earthquake simulation workflow for the default OGRE example.
- Grid Portal Information Repository (UT) demonstrated across large systems such as TeraGrid UT released a production version of the GridPort v3 Toolkit. This included a GPIR v1.0, which also has a web based admin form. GPIR is deployed across NPACI grid and plans for TeraGrid deployment are underway. (UT)
- Additional Outcomes:
  - Grid Application Portals Although not a deliverable for Year 1, the OGCE Toolkit is already in production use, and has been adopted (or plans are underway) by several large grid projects, including:
    - TeraGrid User Portal (UT, IU)
    - LEAD Portal (IU, IU)
    - MEAD Portal (IU)
    - DOE Fusion Portal (UT, IU)
    - SCEC Portal (UT working with SDSC)
    - NEESGrid Portal (UM, IU)
    - NMI Testbed Portal (UT/SURA)
    - UT User Portal v3.0 (UT)
  - Application Manager Portlets: IU also included application manager portlets that demonstrate how to manage application information and integrate this into an

integrated set of portlets that combine GRAM job submission and GridFTP interfaces.

- JSP compatible portlet type: IU developed a JSP compatible portlet type that can be used in place of the normal Velocity-based portlet tools used by the other portlets. This can be used to integrate pre-existing JSP web pages into the OGCE environment. JSP and Velocity portlet development documents are available through the portal collaboratory website.
- Newsgroup system services
- OGRE server-side tools: NCSA is developing metadata-management tasks, based on a client to a web-service currently being elaborated in conjunction with the LEAD project.
- XDirectory Grid Service: this is the backend of the GridContext portlet.
- GridPort 3 Community Scheduling Framework Job Submit Portlet: UT included portlets and services (via the GridPort 3 Toolkit) for interfacing with Community Scheduling Framework services. CSF is an interface for accessing generic job schedulers developed by Platform Computing through the GGF and freely available.
- GridPort 3 Job Sequencer Portlet: UT developed a job scheduling system, with portlet interfaces, that can be used to set up multi-staged jobs across several grid hosts.
- Grid Credential Login: UT developed and integrated a portal login system based on local Grid credentials rather than remote MyProxy credentials. This is set up as an optional build parameter. Use of this build allows clients to utilize the GP3 Credential repository and/or a MyProxy server for login.
- MyProxy-based login system. IU and UM developed a MyProxy-based login system: if you choose this build option, your portal login and password will be mapped to a MyProxy client authentication.
- CoG Workflow portlets The UC team developed workflow portlets on top of the COG kit.
- Condor Portlets: IU developed portlets that allow you to submit and monitor jobs through Condor.
- Single sign-on Investigations: The OGCE team investigated the use of alternative single sign-on technologies for the portal. The UM group has, in collaboration with the MGrid activities and CITI at the University of Michigan, investigated the use of KX.505 credentials as a single sign-on mechanism for the OGCE portal. This sign-on mechanism combines Kerberos and PKI that bridges Kerberos authentication with browser-compatible PKI certificates. KX.509 and mod\_kx509 need to be improved to be made more general and simpler to install. Also, PKI certificate trust chains are complex to maintain. Initial support for KX.509 was included in the second release of OGCE. More work is needed before this is simple to use. The support will be improved in the next release of OGCE.

## **2.4. Programmatic/Managerial Deliverables**

1. *Software design guidelines: style conventions, documentation requirements, and design reviews:* The OGCE team held an all-hands developer meeting in April and began the process of setting standards for coding and directory structure. Many of the plans were

implemented in the May release.

2. *Testing and evaluation guidelines and technologies covering unit, integration, and system testing*: Testing and evaluation guidelines were set at the April developers meeting.
3. *Repository management guidelines*: The OGCE set up a CVS repository for software versioning control and upload reporting. Additional guidelines were set at the April developers meeting.
4. *External oversight committee members meetings*: OGCE holds weekly telcons, where all members participate. Several OGCE meetings were held this year:
  - Grid Portal Consortium PI kickoff meeting May 27-28, 2003 to finalize first year plans.
  - OGCE Developers meeting, April 2004.
  - In addition, the OGCE PIs and developers held project meetings during the following:
    - SC03, Nov 04
    - GlobusWORLD, Jan 04
    - DOE Portals meeting, Feb 04
    - NSF Sci PI, Feb 04
    - Global Grid Forum 10, Mar 04
    - DOE SciDAC PI meeting, Feb04
    - Global Grid Forum 11/HPDC, Hawaii, Jun04

### **3. Year 2 (2004-2005) Overview and Highlights**

During Year 2 of our project, our most important accomplishment was the transition to a new portlet standard (JSR 168) while providing a path of development from the Jetspeed and CHEF-based portlets of our first year release. This new portlet standard should remain viable for several years and allows us to interchange components with non-OGCE containers. This standard also greatly simplifies our portlet application distribution process: we can wrap portlets as separate, supplemental downloads without having to bundle everything as a single, giant download as in Year 1. We also devoted significant effort to providing support, through higher-level programming interfaces, for several different Grid programming tools. This development allows OGCE portlets to support several different underlying Globus toolkits and is being extended to other providers, such as Condor.

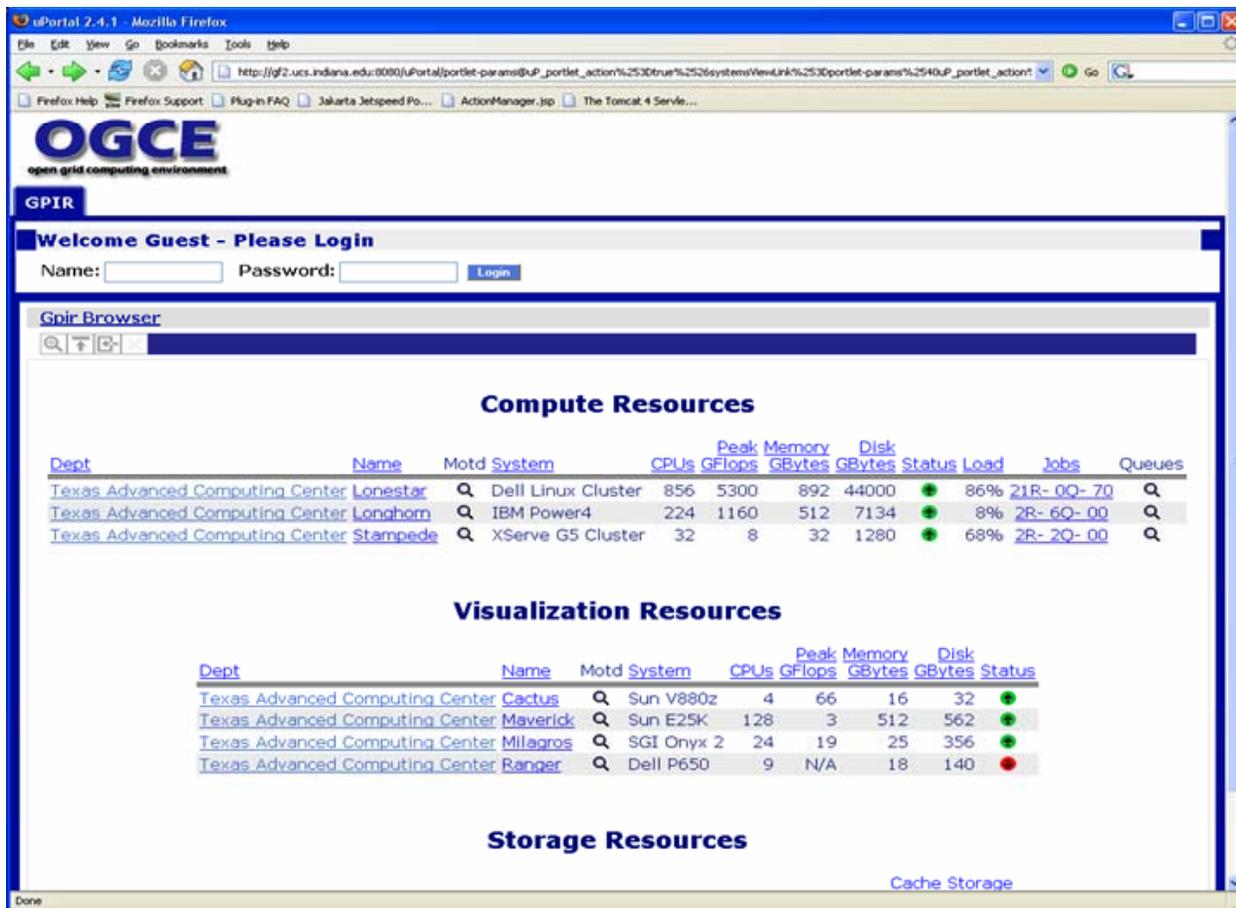


Figure 1: Sample login page and skin for the uPortal-based OGCE

The OGCE has also been prominently involved in the TeraGrid User Portal and Science Gateway efforts. Led by TACC with participation from SDSU and Indiana University, we built the TeraGrid User Portal using (in part) OGCE-developed software. We are also participating in the Requirements and Analysis Team for the TeraGrid Science Gateways, as well as building or contributing to many of these Gateway portals.

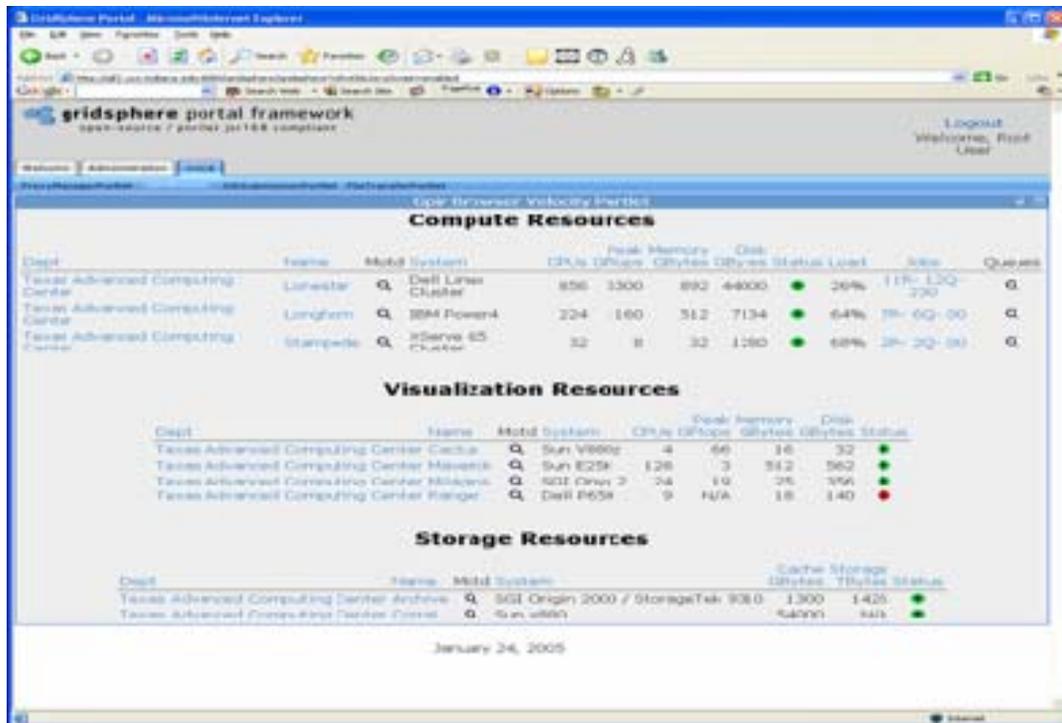


Figure 2: A sample screen of OGCE portlets deployed in the GridSphere portlet container.

Figures 1 and 2 show sample deployments of portlets into uPortal and GridSphere, two open source, JSR 168 compliant containers. OGCE portlets can be deployed into either with a single build process.

### 3.1. Sample Application Portal Projects

OGCE-based application portals are shown in the screen shots below. The LEAD project (Figure 3) builds on OGCE portlets and services for managing linked data and atmospheric simulations.

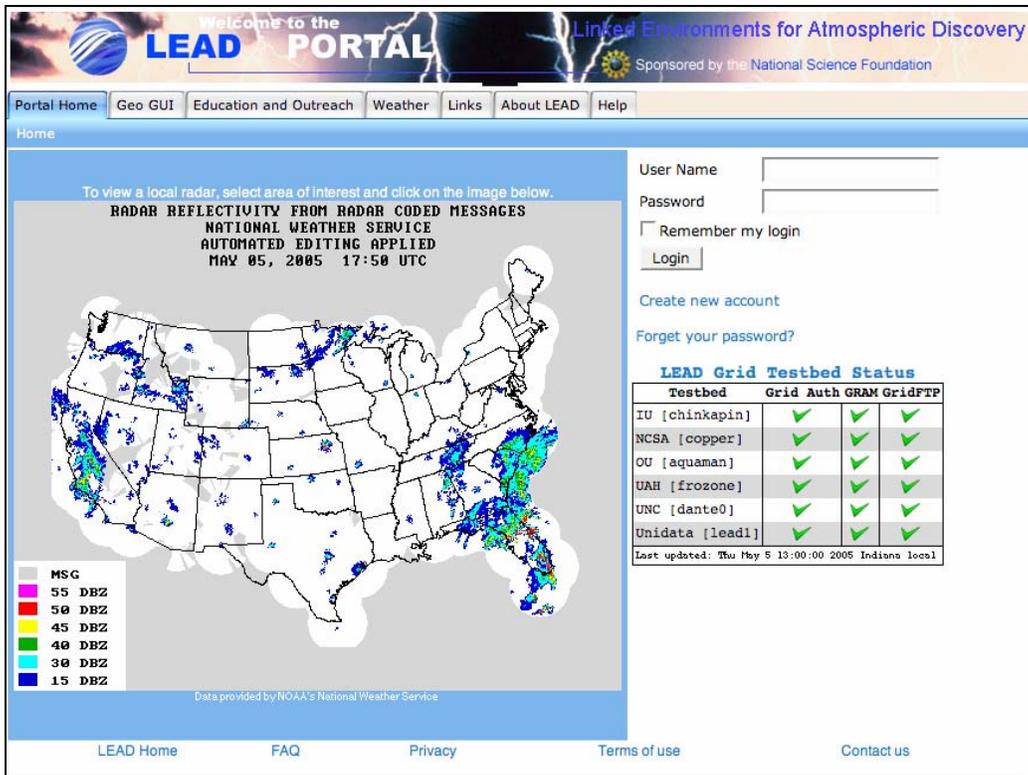


Figure 3: The LEAD portal prototype, built with OGCE and other portlets, is shown running in a GridSphere container.

Figure 4 shows the MyLead data browser portlet running in the uPortal container. The workflow composer applet is shown in the bottom right corner.

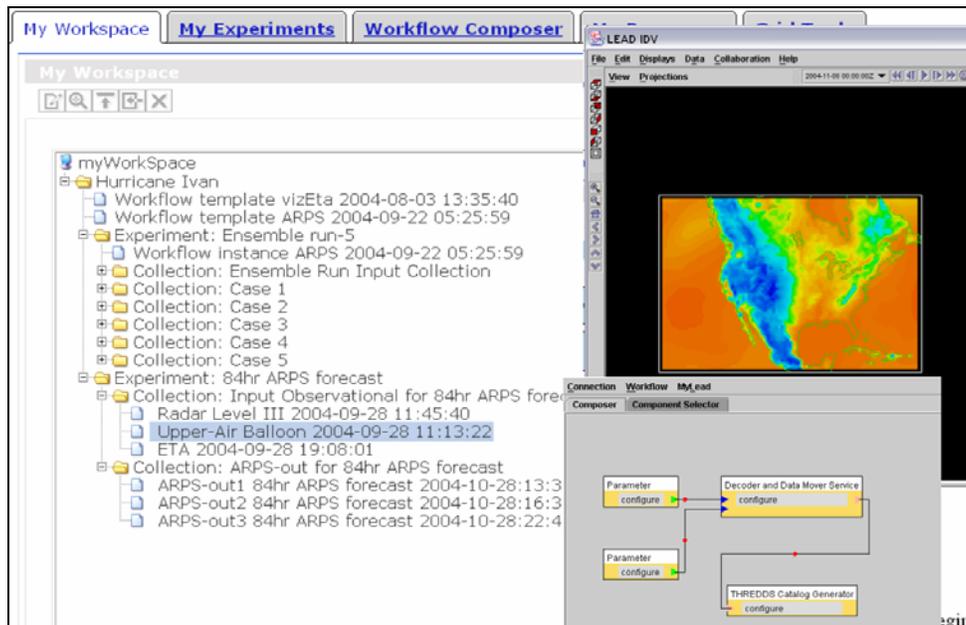


Figure 4: The OGSA-DAI based MyLead portlet and the workflow composer applet.

OGCE team members work closely with the TeraGrid. Figure 5 shows the North Carolina Bioportal, a TeraGrid Science Gateway developed by the Renaissance Computing Institute, which was built using OGCE software.

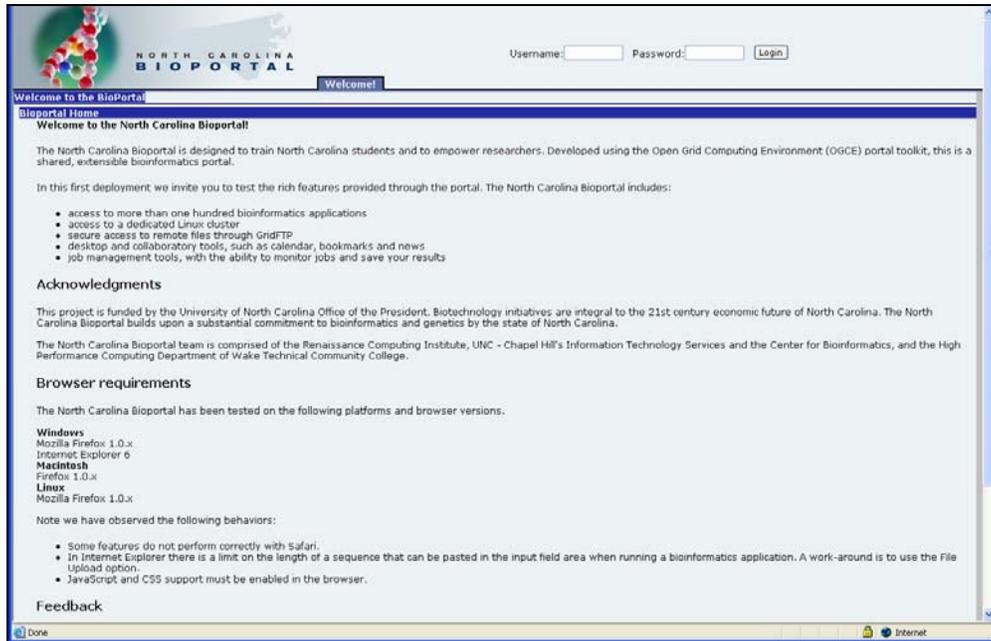


Figure 5: The North Carolina Bioportal, built with OGCE software.

The TeraGrid User Portal prototype, shown in Figure 6, is being designed and developed by TACC using OGCE components. TeraGrid projects often result in feedback to the OGCE. For example, we began our investigation of systems such as PURSe, available from the NMI GRIDS Center, to assist new portal users obtain credentials.

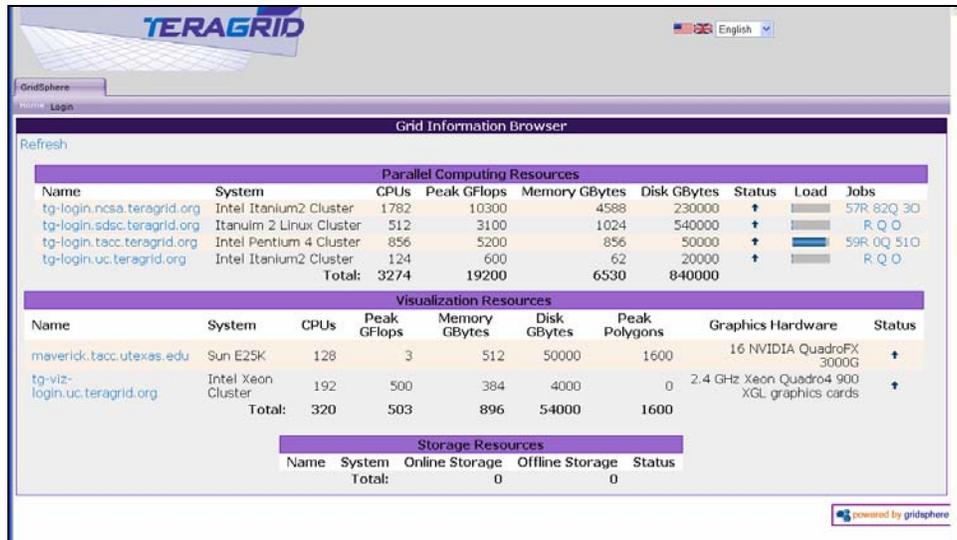


Figure 6: The TeraGrid User Portal is under development at TACC, using OGCE portlets. The screen shot is a very early version of the portal.

Figure 7 illustrates the Southern California Earthquake Center (SCEC) portal, built using OGCE software, provides browser-based interfaces to workflow mapping and execution techniques to map and execute SCEC's Pathways 1 and 2 on SCEC Grid resources. These pathways are represented as application workflows and are generated using either custom web interfaces or the Composition Analysis Tool, and ontology-based workflow composer. The SCEC portal was based on OGCE's Release 1.

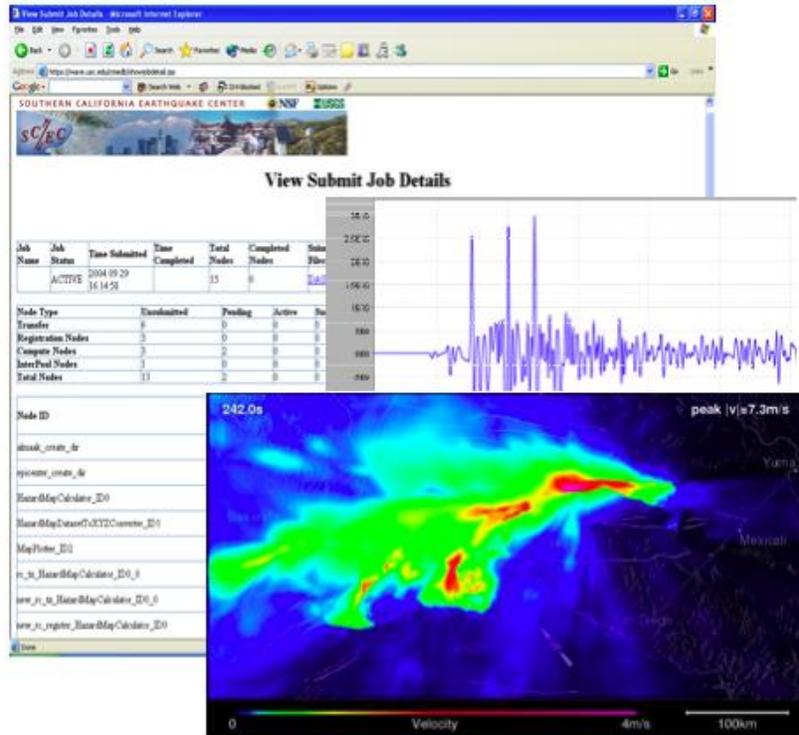


Figure 7: The Southern California Earthquake Center (SCEC) portal is based on OGCE portal software.

### 3.2. Collaborations

The OGCE collaborates with a number of organizations. We list below some groups that are using the OGCE portal software.

Project	Contact	URL
SCEC Digital Libraries Project	Reagan Moore (moore@sdsc.edu); Marcio Faerman (mfaerman@sdsc.edu)	<a href="http://webwork.sdsc.edu:10081/sceclib/index.jsp">http://webwork.sdsc.edu:10081/sceclib/index.jsp</a>
NSF TeraGrid	Charlie Catlett (catlett@mcs.anl.gov)	<a href="http://portal.teragrid.org">http://portal.teragrid.org</a> or <a href="http://alpine.tacc.utexas.edu:14003/gri dsphere">http://alpine.tacc.utexas.edu:14003/gri dsphere</a>
UAB Grid	John-Paul Robinson (jpr@uab.edu)	<a href="http://lab.ac.uab.edu/uabgrid/">http://lab.ac.uab.edu/uabgrid/</a>
LEAD	Kelvin Droege-meier	<a href="http://lead.ou.edu/portal.htm">http://lead.ou.edu/portal.htm</a>

Project	(kkd@ou.edu)	
NanoGromacs	Eric Jakobsson ( <a href="mailto:jake@ncsa.uiuc.edu">jake@ncsa.uiuc.edu</a> )	Under development.
Quest2	Robert Brunner (rb@ncsa.uiuc.edu)	<a href="http://astronomy.ncsa.uiuc.edu/quest2/index.php">http://astronomy.ncsa.uiuc.edu/quest2/index.php</a>
North Carolina Biportal	Lavanya Ramakrishnan (lavanya@renci.org)	<a href="http://www.ncbiportal.org">http://www.ncbiportal.org</a>
QuakeSim Earthquake Portal	Andrea Donnellan (Andrea.Donnellan@jpl.nasa.gov)	<a href="http://complexity.ucs.indiana.edu:8282">http://complexity.ucs.indiana.edu:8282</a>
UC TeraGrid Application Portal	Mike Papka (papka@mcs.anl.gov)	Under development, in collaboration with UC/Laszewski.
Texas Internet Grid for Research and Education (TIGRE)	Phil Smith (phil.smith@ttu.edu)	Under development. TIGRE's Grid and portal development will span several Texas university campuses. This project has recently been funded and will be an important collaboration for OGCE in Year 3. See <a href="http://www.hipcat.net/Projects/tigre/view?searchterm=tigre">http://www.hipcat.net/Projects/tigre/view?searchterm=tigre</a>
Southeastern Universities Research Association (SURA) Grid	Mary Fran Yafchak (maryfran@sura.org)	We are working with SURA to deploy an informational and Grid portal using OGCE portlets and GridPort services (TACC leads).

### 3.3. Activities and Findings

#### 3.3.1. Summary of Activities

This section lists deliverables identified in the Year 1 Annual Report. In addition to the planned deliverables, we have aggressively pursued additional opportunities. We list these additional deliverables to give an idea of the project's scope.

The OGCE's main focus of effort during Year 2 was its transition to JSR 168 compatible Grid portlets. This was accomplished, and in the process we developed tools for porting older Jetspeed, CHEF, and OGCE1 portlets to the new standard. Below we summarize the core development work:

- Developed JSR 168 Compatible Grid portlets for Proxy Management, Job Submission, GridFTP file management, and GPIR-based information services.

- Developed general-purpose Velocity support for JSR 168 portlets. All core OGCE2 portlets are written in Velocity. Velocity is the development tool of choice for Jetspeed 1 and CHEF-based portlets, so this provides a method of transition from the older framework.
- Developed high-level Grid programming interfaces, co-released in the Java CoG 4 Kit and OGCE2 downloads. These hide the differences between various Globus toolkit versions: GT2, GT3.0, GT3.2, and GT4.0.
- Developed support for multiple Grid client environments within the same portal. That is, the higher-level APIs may be bound to different GT versions within the same portlets.
- Repackaged Open GCE Runtime Engine into component libraries, to ease subsequent reuse.
- Released Trebuchet desktop data management application.
- Developed supplemental data sharing portlet capabilities that allow portals to share proxy credentials.
- Developed an Apache Maven-based build, documentation, and test environment. This allows single portlet builds using remote Java jar repositories and improves over our previous Apache Ant-based build system. Users can deploy into either uPortal or Gridsphere containers.
- Developed an extensible unit testing environment (based on HTTP Unit) that can be used to verify the portal release. This is integrated with Maven to test the portal builds and produce summary reports.
- On-line and downloadable documentation: all system documentation is written in XDoc format for easy distributions and management within the OGCE2 download. Documentation can be built with Maven.
- Developed new suite of JSR168 GridPort Portlets including GPIR, Job Sequencer, Comprehensive File Transfer, and SRB portlets.

### 3.3.2. Supporting Collaborative Communities

Below are the collaborative deliverables. The percentage completion refers to the status of the project at the end of Year 2.

Deliverable	Lead	Status	% Complete
TeraGrid User Portal Design and Development	TACC	Eric Roberts/TACC leads the design, documentation, and implementation efforts. Demos were given at supercomputing. Documents are listed in the "Publications and Reports" section.	100% All Year 2 deliverables were met; work will continue in Year 3.
Integrate Selected NEESGrid and CMCS portlets	All	Joe Futrelle (NCSA) successfully ported his NEESGrid Metadata System to OGCE2	50% We have contacted CMCS but have not gotten a

		using OGCE's Velocity tools.	commitment. (100% for NCSA NEESGrid work)
Participate in DOE SciDAC Portal Consortium	SDSU/TACC	M. Thomas/SDSU leads the DOEPC. Team successfully demonstrated collaborative tools (GlobalMMCS/IU, collaborative IDL/IU) as well as portal capabilities; conceptualized and began work on significant Fusion Data Grid portal activity.	100% Deliverables were met. Plans for production Fusion portal delayed due to operation schedule of Tokamak, but will begin during Summer 05
TeraGrid Science Gateway Portal efforts*	TACC, Indiana	Roberts, Gannon, and Christie are on the Gateway's Requirement and Analysis Team. Documents are listed in the "Publications and Reports" section.	100% This is an ongoing effort.

### 3.3.3. Global Software Deliverables

Global deliverables involve the cooperation of most or all team members to develop and test. Starred deliverables are additions. The completion percentage gives the project status at the end of Year 2.

Deliverable	Lead	Status	% Complete
Migrate Grid portlets to support JSR 168	Indiana, TACC, NCSA	This was completed and demonstrated at Supercomputing 2004 using both Grid Sphere and uPortal containers.	100%
Fully JSR 168 Compatible Release	All	This is in preparation, will be available concurrently NMI R7.	90% This will be released in early June.
Portal Services Standards	Indiana	We identified inter-portlet communication as the key missing service (needed to share portlet credentials between	75% We will continue this investigation over the summer.

		portlets). This was implemented and included in the current release.	
Portal Support for GT2, GT3, and GT4	U. of Chicago	This is available in the portal through the Java CoG Kit.	100% This is an ongoing task.
Simultaneous support for multiple Globus Toolkit Versions*	U. of Chicago	Integrated CoG APIs support all major Globus toolkit releases; portal can be used to run jobs with several different GT versions. CoG classloading system was modified to work with portal and Tomcat environment.	100% This is an ongoing task.
Generic Portal API for major Grid services	U. of Chicago	This is part of the co-released CoG 4 and OGCE2.	100%
Portal Support: GridPort Toolkit	TACC/SDSU	Middleware support for subset of OGCE portlets	100%
Unit Testing Framework *	All	Develop using Maven and HttpUnit. Included in current release. All core portlets have Maven tests. We have also done initial portal stress testing with JMeter.	100%
Velocity Portlet Support in JSR 168 *	Indiana	Completed and available in current release.	100%
Maven-based remote repository for software distribution.*	All	All major subcomponents of the OGCE are available through public Maven repositories.	100% This is an on-going task.
Integrated, Maven-based build system. *	All	Available in current release. In addition, we have developed a Maven tool for simplifying supplemental portlet deployment.	100%

JMeter Performance Testing*	TACC, Indiana	Tested performance OGCE portlets in GridSphere portal to handle large numbers (~800) of user sessions concurrently. Also performed similar JMeter testing of OGCE in uPortal. We tested multiple simultaneous logins and credential fetching operations and were able to support over 1100 operations in uPortal. Extended test scripts are available in the OGCE tutorial material (see Presentations below.	100%
-----------------------------	---------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------

### 3.3.4. Indiana University Local Deliverables

IU's efforts during Year 2 focused on leading the overall portal build and deployment integration. We also developed a number of specialized portlet components outside the core release that are available for supplemental download.

Deliverable	Outcome	% Complete
Deliver A/V portlets to manage Polycom/H.323, Access Grid, and other connections	This was demonstrated at SC04 and is available as a supplemental portlet download from <a href="http://www.collab-ogce.org">www.collab-ogce.org</a> . Available now for uPortal, Gridsphere version available in early June 2005:	100%
GIS Portlets and Services	We have developed version of the Web Feature Service, Web Map Service Open Geospatial Consortium Standard. WFS is available for download; WMS is being packaged; Portlet Map client is being packaged for release. All should be available for June 1. Releases are posted at <a href="http://www.crisisgrid.org">www.crisisgrid.org</a> and will be linked to the <a href="http://www.collab-ogce.org">www.collab-ogce.org</a> web site.	100%
Complete an application factory web service and associated portal.	The application factory allows an application designer to automatically generate a web service and a portal interface to configure and run the application.	100%

	See <a href="http://www.collab-ogce.org">http://www.collab-ogce.org</a> and <a href="http://www.extreme.indiana.edu/portals">http://www.extreme.indiana.edu/portals</a> for a tutorial and download instructions.	
Provide a mechanism for portlets to use web services security to authorize users to access remote services.	We have developed a “capability-based” authorization system that allows special authorization “capability tokens” to be assigned to portal users. When the user access a portlet for a remote web service, the user’s authorization tokens are sent to the service which verifies the tokens and allows the user access. If a user was not granted a capability, access is not permitted. A capability management portlet was also delivered. (This technology is used in the application factory.) See <a href="http://www.collab-ogce.org">http://www.collab-ogce.org</a> and <a href="http://www.extreme.indiana.edu/portals">http://www.extreme.indiana.edu/portals</a>	100%
Deploy an OGSA-DAI based metadata catalog and associated portlet.	We have developed a personal metadata catalog that allows user to keep track of files and scientific experiments that were conducted on the Grid. The user navigates their metadata space with a browser portlet with a rich query interface. The metadata catalog has been deployed in the LEAD portal where it is called “myLEAD”.	100%
Provide a portlet to search a service registry. *	We have developed a registry with a portlet interface to search registered web services and other data objects. The services may be applications of interest to the user and the data objects may be registred data streams. See <a href="http://www.collab-ogce.org">http://www.collab-ogce.org</a> and <a href="http://www.extreme.indiana.edu/portals">http://www.extreme.indiana.edu/portals</a>	100%
Provide a portlet that can be used to design and execute remote workflows. *	We have built an “Experiment Builder” portlet that can allow a user to compose a workflow from applications services and bind data values to the workflow parameters. The resulting workflow enactment is saved as an “experiment” in the metadata directory described above. The workflow composer has a “drop-and-drag” tool that allows the user to compose the workflow graphically. (See Figure 4.) See <a href="http://www.collab-ogce.org">http://www.collab-ogce.org</a> and <a href="http://www.extreme.indiana.edu/portals">http://www.extreme.indiana.edu/portals</a>	100%

### 3.3.5. University of Chicago Local Deliverables

Several of these deliverables were affected by (a) delays in the Globus Toolkit 4 release plans and (b) significant changes in the Toolkit in regards to functionality, semantics, and APIs. At the time the original proposal was written, none of these changes were foreseeable. We anticipate full completion of delayed deliverables. The frequent modifications to the GT4 toolkit resulted in significantly more development and testing time than originally anticipated.

Deliverable	Outcome	% Complete
Assist in the move of the Web site and code repository to Indiana University.	We moved part of the Web site to Indiana University. The CVS repository is still maintained at ANL as the system support staff at IU is understaffed. This task will be closed and can be considered completed.	100% Web site and downloads are available from IU. We left the CVS repository at ANL for better system support and won't move.
Integrate Condor into the Java CoG Kit	Provided a direct port of Condor services within the Java CoG Kit allowing the development of Condor style job submissions directly through the Java CoG Kit.	100% We have within the Java CoG Kit a provider that can submit to Condor.
Provide a port of the Java CoG Kit for different GT versions.	Developed CoG Kit providers for versions GT2, GT3.0, GT3.2.1, GT3.9.5, GT4.0, as well as eight additional intermediate releases	100%, Several additional releases were necessary as the design of newer Globus toolkit version changed and their design was not intended and thus not available at the time of the project planning. We estimate that we put in about 4 times the amount of effort to keep up with these unexpected changes.
Integration of Java CoG with new OGCE portlet deployment framework.	This was completed with assistance of IU. The JSR 168 standard requires modifications to our earlier (Year 1) Java JAR deployment. We also modified the CoG's class loading methods to work inside the Tomcat servlet container.	100%
Continue the support of older Globus Toolkit	Provided support for CoG Kit providers for versions GT2, GT3.0,	100%, Due to unexpected changes

versionsGT2.4	GT3.2.1, GT3.9.5, GT4.0, as well as eight additional intermediate releases	in the GT releases we needed to spend more time on this item as originally anticipated and communicated to us by the GT project.
Support for future Globus toolkit versions	Due to the enormous effort to constantly update between GT versions we have improved our provider concept to make it easier to adapt to new GT versions	100% This is an ongoing effort.
Development of a File Access mechanism as part of the Java CoG Kit for the development of a File access portlet	It is now easy to conduct file access operations through a Java CoG Kit provider.	100%
Development of a prototype of a Grid Command manager that can be started through Webstart within the portal and is used to manage many user controlled jobs.	Due to Globus toolkit bugs and its software release postponement by 6 month this task was not started. The Web start component has not been started yet.	50% Due to the delay in the Globus Toolkit 4 deliverable this task has been started.
Improvement of the workflow services while using the newest service oriented Grid technologies.	Due to the delays in the GT release this task has not been completed.	0% We will start this task over the summer and expect a first version to be available in September.
Support of WebDAV in the File access component as part of the Java CoG Kit	The CoG Kit has now integrated support for accessing WebDAV servers.	100%
Development of a Portlet to the Simple CA to allow other communities to more easily run their own certificate authority.	A new effort of the Grids center called PURSE was started. Therefore making this task unnecessary. We are currently examining OGCE/Purse integration. This effort will more naturally be led by TACC, and we are switching the TACCC Pegasus workflow deliverable with this one.	0% OGCE is investigating integration to use PURSE.
Investigate the possible integration of smart cards	It was determined that this task is of low priority and therefore was not	0% Removed from deliverables list as

and other external devices as part of the security integration within the portal.	started	no longer needed. We do not anticipate further work on this deliverable.
Assist the GGF SAGA working group in formulating documents for a simplified API to the Grid.	This is an ongoing process. Participated at GGF and in several meetings.	100% This is an ongoing task.

### 3.3.6. SDSU Local Deliverables

In September, 2005, PI Thomas moved from TACC to join the Computer Science Department faculty at San Diego State University. The grant was moved and TACC remained funded on project as a co-PI/subcontractor. PI Thomas started the Advanced Computing Environments Laboratory (ACEL: <http://acel.sdsu.edu>). With funding from SDSU, NSF and DOE grants, 4 Dell 1850 servers, a 6 TB storage facility and a Cisco Gig-E router were purchased. This hardware is used in a graduate level course, "Introduction to Grid Computing," taught by Thomas in Spring 2005. The hardware currently hosts GT4/WSRF and pre-WS GT3.2, all OGCE/uPortal/GridSphere frameworks, as well as supporting toolkits such as GridPort3 (GP4) and JavaCoG, and an SRB/MCAT service.

Deliverable	Outcome	% Complete
GridPort Toolkit implementing OGCE Interfaces and supporting OGCE API	GridPort 3 using CoG 4 API for OGSi Job Submission interface to GT3	100%
Storage Resource Broker (SRB): working with SDSC team to create portlets and web services for SRB	Seth contributed to the design and implementation of the JSR168 SRB portlet interface.	100%
General Portlet interfaces	Regno and Thomas developed SRB Portlets; collaborating with TACC to develop GP3 portlets	75% We anticipate completion by the end of Year 2.
Secure GPIR Ingestor Service	Prototyped GT4/GSI enable GPIR Ingestor service	20%. This prototype will be extended to GPIR query service and used by GPIR Portlets. Expect completion by SC 05
DOE Fusion portal	SDSU migrating GP3/OGCE JSR168 portal onto Fusion resources and integrating SRB	50%. Expect alpha portal by end of June, 2005.
Development of OGCE interfaces and patterns	This is part of the co-released CoG 4 and OGCE2.	100%

(Working directly with Argonne)		
Investigate use of Advanced Javascript and XML Architecture (AJAX) for portlet client browser capabilities	SDSU has tested use of AXAJ on the client side and portlet hosting side. Both appear to work very well for SRB Portlets. Plan to extend in 05/06 to other GP4 portlets	50% for SRB Portlets. Expect integration into OGCE-2 by SC 05.
Cascading Style Sheets (CSS) for Portlet skins	Investigated how to change skins and style sheets for uPortal/GridSphere	25%. Expect in Year 2 to deliver various skins.
Pegasus Workflow portlets	This task was exchanged with UC. SDSU/TACC are investigating user registration services and UC is investigating workflow.	0% TACC/SDSU expects significant progress on PURSE over the summer.

### 3.3.7. TACC Local Deliverables

Deliverable	Outcome	% Complete
GridPort Toolkit implementing OGCE Interfaces and supporting OGCE API	GridPort 3 using CoG 4 API for OGSi Job Submission interface to GT3	100%
General Portlet interfaces	Seth and Roberts created comprehensive GridFTP file transfer, GRAM job submission, Condor job submission, GPIR Browser portlet; Regno and Thomas developed SRB Portlets	75% We anticipate 100% completion by the end of Year 2.
TeraGrid User Portal	Roberts led a Requirements Analysis Team (RAT) to define requirements for integrating streamlined account management through the TeraGrid User Portal. See document authored by Roberts et al in publications and reports section	100%
Portal account creation and management portlets, including session to session persistence via GPIR.	Account creation and management portlets are included as part of the GridSphere and uPortal distributions.	50% uPortal account management was developed in collaboration with UC and IU. GridSphere account management enhancements not needed.

Pegasus Workflow portlets	Support for Pegasus workflow tools. We have switched this workflow deliverable with UC, in exchange for their Simple CA deliverable.	0% We are evaluating PURSe and GAMA tools for certificate management. This is a TeraGrid requirement. This deliverable is switched with UC, who will investigate Karajan workflow. We anticipate significant progress before the end of Year2.
TACC Molecular Dynamics Portal: deliver portlets for the following MD applications: NAMD, AMBER and GROMOCS.	Seth and Roberts gathered user requirements for NAMD portlet interface. Designed prototype interface, gathered user feedback. Developed and packaged v1.0 based on feedback.	33% NAMD completed. AMBER portlets delayed because we don't have licenses yet. We expect the AMBER portlets to be done within year 3. GROMOCS portlets delayed because there is not a strong need from the UT Bio community for this application. We will be reevaluating the level of need in Year 3.)
DOE Fusion portal	Seth developed an application portlet used to submit jobs to the TRANSP application.	100%
TACC developing TACC User Portal, UTGrid User Portal and TIGRE User Portals based on OGCE software	Developed serial distributed job submission interface that will be rolled into the TACC User Portal which is planned for completion in Summer of '05. The TIGRE project has not started yet because of delays in funding.	50% Completion of TIGRE project depends upon external funding. This project has recently been initiated and will be a significant collaboration for Year 3.

TACC User Portal (TUP) bundle	Currently deployed SURA portal uses this bundle which includes OGCE portlets	100%
-------------------------------	------------------------------------------------------------------------------	------

### 3.3.8. NCSA Local Deliverables

Deliverable	Outcome	% Complete
Grid Desktop Graphical User Interface	We released NCSA Trebuchet, a desktop graphical user interface for data management. This is available as a Java Web Start application from the OGCE website. Development of more comprehensive desktop interfaces is underway in support of LEAD; a subset of this will be released in the next OGCE release	75% File management complete, more comprehensive interface in development, also, developing portlet interfaces to manage remote execution of OGRE. Expect prototype of more full-featured desktop GUI by end of project year 2)
Extend Sample Application to Show More Data Elements	In progress, as collaboration with tupelo and molecular dynamics, and with LEAD and myLEAD.	50% This has turned out to be substantially more complex than initially estimated, we aim for completion and delivery in year 3, continued engagement with application teams critical for success here.
Portlet Client/NEESgrid metadata repository	Repository release June 2005, with sample portlet. More substantially, richer data functionality in support of molecular dynamics portal.	75% Core functionality in place, application-specific functionality in progress.

### 3.3.9. University of Michigan Local Deliverables

The OGCE release 1.0 was based on the Michigan CHEF toolkit and as such it contained the collaborative tools provided by CHEF as well as the grid tools built for the NEES project and by

the OGCE project. In order to move towards the more standard JSR-168 portal standards, OGCE versions 2.0 and later are based on JSR-168. Effectively this choice meant that all of the collaborative tools from CHEF no longer worked in OGCE version 2.0. At the same time, the CHEF project transformed into the Sakai project. Sakai is a far larger project than CHEF with hundreds of institutions involved and has resulted in significant improvement in the overall quality of the Sakai code base.

The primary contribution for Years 2 and 3 is to get Sakai "back into" the OCGE environment. There are several approaches to the re-integration of Sakai into OGCE. These include the use of iFrames, Web Services for Remote Portals (WSRP), and JSR-168. This integration will initially take place before the end of Year 2, following the release of Sakia 2.0 in mid-June. However, these are quite challenging and will likely be fully delivered in the year three timeframe.

<b>Deliverable</b>	<b>Outcome</b>	<b>% Complete</b>
iFrames for Sakai	This is available in Sakai 1.5. But this base capability allows JSR-168 portals to include Sakai tool instances to be presented in uPortal and other portals.	100%
Combine OGCE and Sakai through IFrames.	This will be a document aimed at system administrators showing how to install OGCE and Sakai and connect them together using iFrames. We will also assist in setting this up for a select set of OGCE adopters.	5% - This will be completed by August 31, 2005.
WSRP For Sakai	A very simple prototype of this was developed and demonstrated early in Year 2. Since then a very significant effort has been mounted to build a native and fully functional WSRP producer for Sakai and to liaison with the uPortal 3.0 developers to enhance the WSRP consumer in uPortal 3.0. The WSTP producer is expected to be delivered in Sakai 2.1 in October 2005.	75% - the major code issues have been resolved and are awaiting integration into the Sakai 2.0 kernel. This integration will be done summer 2005. There may be some required tool modifications for a few of the Sakai tools so as to work properly over WSRP.
JSR-168 for Sakai	This effort will port the Sakai 2.0 kernel into uPortal 3.0. Once this kernel port is done, many of the Sakai tools will be able to run native in uPortal as JSR-168 applications	5% - a basic design is in place but no further effort has gone into this activity. This work

	and be instanced directly using uPortal administration mechanism.	will commence upon the successful completion of the WSRP activity.
Sakai Research Discussion Group	The Sakai project has focused a great deal of effort on adding new learning oriented tools to the CHEF toolset. The Sakai Research DG is a group formed to focus attention on the needs and requirements for the use of Sakai in a Research context. The members founding members of this group are primarily from the NEES and UK E-Science effort.	100% complete.
Develop Sakai Grid Version	This effort produced a Sakai Grid kit for the Sakai 1.0 release to enable grid development in Sakai 1.0.	100% complete

### 3.3.10. Outreach Deliverables

Our major deliverables included demos, presentations and posters at Supercomputing 2004; the integration of OGCE and general grid material into graduate and undergraduate curricula; and numerous tutorials.

Deliverable	Lead	Status	% Complete
Demonstrations at Supercomputing 2004	All	We organized demonstrations at the Alliance, Indiana, and TACC booths.	100%
TeraGrid tutorial at Supercomputing 2004	TACC	Eric Roberts demonstrated a development version of the TeraGrid User Portal for current and potential TeraGrid users during a comprehensive TeraGrid tutorial.	100%
Participation at Globus World	All	Gregor von Laszewski gave two presentations	100%
Participation in Global Grid Forums	All	Gannon and Fox both serve on GGF steering committees. Gannon and Pierce participated	100%

		in the GGF 12 Portals tutorial. Gannon also gave a shorter portal tutorial at GGF 13. We are reviving the GCE group for GGF 14.	
Grid Portals Tutorial	All	Gannon and Pierce gave a tutorial at GGF 12. Gannon gave a shortened version at GGF 13. Thomas and Pierce gave a tutorial at HPC 2005. See Training and Outreach for more details.	100%
Supercomputing 2004 Posters*	IU and University of Chicago	Pierce and Laszewski had three posters selected for SC04. Laszewski's poster won the coveted "SC Best Poster" from 109 submissions.	100%
Distance Education*	Indiana	Pierce delivered a set of lectures on using portlets as part of a distance education course offered to Jackson State University.	100%
REU site on Grid computing and bioinformatics*	University of Chicago	8 undergraduates and 8 graduate students participated in an REU co-hosted by University of Chicago (von Laszewski co-PI at Chicago) to learn about Grid computing. 3 undergraduates were part of the best poster award at SC2004	100%
GridPort Training*	TACC	Held multiple training classes throughout the year (see training and outreach section below). Hosted Venezuelan visitors for	100%

		3 weeks training them in OGCE and GridPort. Built Gaussian application portlet, and conducted GT4 evaluation.	
SDSU Course: Introduction to Grid Computing*	SDSU	Thomas taught a semester-long graduate course on Grid computing using OGCE, Globus, and Grids Center software.	100%
Attend uPortal Developers meeting	UM	UM has attended each of the iuPortal developer's meetings and provided direction w.r.t. uPortal's directions in WSRP and acted as a liason w.r.t. OGCE's erequirements for uPortal.	100%, Ongoing
Liason with NEES Project	UM	Interact with NEES and NSF personnel regarding the directions of the NEESGrid software to move them to a Sakai and ultimately OGCE based portal.	100%, Ongoing
Participate in the Sakai Research Discussion Group	UM	The Sakai project has focused a great deal of effort on adding new learning oriented tools to the CHEF toolset. The Sakai Research DG is a group formed to focus attention on the needs and requirements for the use of Sakai in a Research context. The members founding members of this group are primarily from the NEES and UK E-	100%, Ongoing

		Science effort.	
Liason with the CMCS project	UM	The CMCS project currently uses CHEF as its collaborative environment. We would like them to evolve to an OGCE based solution. We are working with them and communicating as the CMCS project makes decisions regarding its future direction.	100%, Ongoing

### 3.4. Products, Software, and Web Sites

The OGCE's primary website is <http://www.collab-ogce.org/>, with links to software downloads tutorials, publications, and related portal efforts. Several portals built with OGCE software are listed in Section 4.

### 3.5. Training and Outreach

1. Gregor von Laszewski, Jay Alameda, Greg Daues, and Marlon Pierce, meeting with NMI GridChem Team, NCSA, April 18, 2005. Primary topic of discussion was building workflow clients and tools using the Java CoG kit.
2. Eric Roberts, Akhil Seth, Maytal Dahan hosted 4 visitors from Venezuela April 10-30 training them in OGCE and GridPort. Built Gaussian application portlet, and conducted GT4 evaluation collaboratively.
3. Mary Thomas and Marlon Pierce, [Tutorial on Grid Portals](#) HPC2005 April 4 2005 and NCSA portals meeting, Jan 26 2005.
4. Charles Severance, [Sakai Portal Approach](#), uPortal Developer Meeting, Los Angeles, California, March 22, 2005.
5. Charles Severance, Sakai and OGCE Directions, CMCS All Hands Meeting, Salt Lake City, Utah, February 3, 2005.
6. Beth Kirshner, Sakai Impact on CHEF Development, NEESGrid CHEF Development Workshop, San Diego, CA, May 6, 2005.
7. M. Thomas, Introduction to Grid Computing, SDSC graduate course CS696. Web site: <http://rohan.sdsu.edu/faculty/~mthomas>
8. Geoffrey Fox and Marlon Pierce, "High Performance Computing and Computational Science." Spring 2005 Graduate Course taught in conjunction with Jackson State University. Course material included OGCE topics on portlet development and simple computational services. Course Web Site: <http://grids.ucs.indiana.edu/ptliupages/jsucourse2005/>. Course funding was provided by the DOD High Performance Computing Modernization Program.
9. Marlon Pierce and Gordon Erlebacher, meeting with Quantum Espresso developers, Cineca, Bologna, Italy. This was part of a VLab effort (an NSF funded ITR project to build a computational chemistry grid). The Espresso team provides a state of the art suite

of Molecular Dynamics codes. We will be building a portal and services to support grid applications surrounding the Quantum Espresso suite using the OGCE portal software. We also discussed other OGCE portlet efforts, particularly SRB portlets.

10. Eric Roberts, Akhil Seth. "Building Grid Enabled Portals using GridPort 3" TACC training Austin, Texas December 10, 2004
11. Maytal Dahan, [Building Grid Enabled Portals using GridPort 3](#) Merida, Venezuela November, 2004
12. Eric Roberts, [GridPort: A Toolkit for Building Grid-enabled Portals](#) Supercomputing 2004, November 8-12, 2004. Presented at TACC booth throughout the week of Supercomputing 2004.
13. Eric Roberts, Maytal Dahan, Akhil Seth. [Building Grid Enabled Portals using GridPort 3](#) TACC training Austin, Texas October 25, 2004.
14. Marlon Pierce and Dennis Gannon, [Developing Grid Portals Using Portlets](#) Global Grid Forum 12 Portal Tutorial Brussels September 21 2004.
15. Maytal Dahan, Eric Roberts, Akhil Seth. [Building Grid Enabled Portals using GridPort 3](#) Monterey Grid Computing Conference at FNMOC, Monterey, California September, 2004.
16. von Laszewski. REU site for Grid Computing and Bioinformatics, U of Chicago and ANL Von Laszewski hosted an REU site at ANL in collaboration with University of Chicago and DePaul University. 8 undergraduates and 8 graduate students participated
17. von Laszewski, Course project on Grid computing, Illinois Institute of technology, Fall 2004. Von Laszewski supervised 5 students at IIT to conduct projects related to Grid computing.
18. Maytal Dahan, Eric Roberts, Akhil Seth. [Building Grid Enabled Portals using GridPort 3](#) TACC training Austin, Texas August 17, 2004.
19. Charles Severance, [Sakai and uPortal: Taking Collaboration to the Next Level](#), Keynote Speech uPortal User's Meeting, Denver Colorado, June 22, 2004.
20. Charles Severance, [Grid Portals: Putting the User Interface on the Grid and Virtual Organizations](#), [NEESGrid - A Grid Portal Study](#), and [Sakai Architecture and Roadmap](#), Grid Summer School, Vico Equense, Italy, July 22, 2004.

## 3.6. Publications

### 3.6.1. Presentations and Posters

1. Gregor von Laszewski. Grid Workflow with the Java CoG Kit 4. Austin, TX, 13 May 2005.
2. M. Thomas. "Impact of Cyberinfrastructure on Grid Computing" Invited Talk: SDSU Colloquim, 28-Apr-05, San Diego, CA.
3. Eric Roberts, Steve Quinn, Von Welch, "TeraGrid Account Management through the TeraGrid User Portal", TeraGrid All Hands Meeting April 5, 2005.
4. Dennis Gannon, Invited Speaker, "Grid Portals Mini Tutorial", Global Grid Forum, Seoul Korea, March 2005.
5. Marlon Pierce, "SERVOGrid and GIS Services," SCIGN REASoN Team Meeting, NASA Jet Propulsion Laboratory, Feb 17, 2005. This overviewed portlet-based application portal work with SCIGN Data Portal development team, <http://reason.scign.org/scignDataPortal/>.

6. Gregor von Laszewski. Grid Programming Patterns with the Java CoG Kit 4. GlobusWorld, Boston, Massachusetts, 7-11 February 2005.
7. Gregor von Laszewski. Workflow support in the Java CoG Kit 4. Boston, Massachusetts, 7-11 February 2005.
8. Eric Roberts, Invited Speaker, GridPort: [A Toolkit for Building Grid-Enabled Portals](#) Portals, Portlets and GridSphere Workshop CCT, Louisiana State University, Feb 3-4 2005, Baton Rouge, LA, USA
9. Geoffrey Fox [iSERVO International Solid Earth Research Virtual Observatory: Grid/Web Services and Portals Supporting Earthquake Science](#) American Geophysical Union Fall Meeting, San Francisco, December 15 2004.
10. Geoffrey Fox and Marlon Pierce [Data Grids for HPC: Geographical Information System Grids](#), Internet Seminar to Jackson State University, Florida International University, and University of Hawaii, 7 December 2004.
11. Marlon Pierce, Marcus Christie, and Eric Roberts: [The Open Grid Computing Environments Collaboratory](#) OGCE portal demo at SC04 Thursday, Nov 11, 12:30 pm to 1:30 pm. with [Additional Material](#)
12. Marlon Pierce, Greg Daues, Gopi Kandaswamy, and Liang Fang [NCSA Alliance Portal Expedition Demo](#) Alliance/OGCE portal demo at SC04 Wed, Nov 10, 1:00 pm - 1:30 pm with [Additional Material](#).
13. Eric Roberts, [GridPort: A Toolkit for Building Grid-enabled Portals](#) Supercomputing 2004, November 8-12, 2004. Presented at TACC booth throughout the week of Supercomputing 2004.
14. Eric Roberts, Invited Speaker, [TeraGrid: Learn Once Run Anywhere](#), TeraGrid Tutorial at Supercomputing 2004 Monday Nov 7, 2004 Gave demonstration of TeraGrid User Portal.
15. Marlon Pierce and OGCE Collaboration posters for SC04
  - a. [OGCE Release 1 Combines Grid and Collaboration Portlets in CHEF Framework](#)
  - b. [Standard Portlet Architecture Supports Reusable Components](#)
  - c. [OGCE Portal Applications for Grid Computing I](#)
  - d. [OGCE Portal Applications for Grid Computing II](#)
16. Gregor von Laszewski. Grid Computing. Illinois Institute of Technology, October 2004.
17. Marlon Pierce, [Portals and Portlets](#) DOD User Interface Specification group meeting Atlanta September 27 2004.
18. Gregor von Laszewski. Keynote: Cog kit abstractions. Workshop on Grid Application Programming Interfaces in conjunction with GGF12, Brussels, Belgium, 20 September 2004. (Keynote). <http://www.cs.vu.nl/ggf/apps-rg/meetings/ggf12.html>.
19. Dennis Gannon, Keynote Speaker, "Building Grid Applications and Portals: An Approach Based on Components, Web Services and Workflow Tools," Europar, Pisa, Aug. 2004.
20. Geoffrey Fox and Marlon Pierce [SERVO Grid: Solid Earth Research Virtual Observatory Grid/Web Services and Portals Supporting Earthquake Science](#) Jade Palace Hotel Beijing (863 Project Grid) August 26 2004.
21. Dennis Gannon, Invited Speaker, "Component Models and Distributed Services", SC4 DEVO - Workshop on Service Composition for Data Exploration in the Virtual Observatory, Caltech, July 2004.

22. Geoffrey Fox, Marlon Pierce [SERVO Grid: Solid Earth Research Virtual Observatory Grid/Web Services and Portals Supporting Earthquake Science](#) Fourth ACES (APEC Cooperation for Earthquake Simulation) Workshop, Beijing China, July 13 2004. This was accompanied by an earthquake modeling application portal demonstration using the OGCE-based QuakeSim portal.
23. Geoffrey Fox [iSERVO and SERVOGrid: \(International\) Solid Earth Research Virtual Observatory Grid/Web Services and Portals Supporting Earthquake Science](#) US-Australia Workshop on High-Performance Grids and Applications, Swiss Grand Hotel, Bondi Beach, Sydney, June 8 2004
24. Dennis Gannon, Keynote Speaker, "Building Applications from a Web Service based Component Architecture". ICS 2004 Workshop on Component Models and Systems for Grid, St. Malo, France, June 2004.
25. Dennis Gannon, Invited Speaker, "Experience Building Grid Applications with the CCA Software Component", Second Reality Grid Workshop, Royal Society, London, June 2004.
26. Gregor von Laszewski. Java cog kit workflow abstractions. GGF Workshop Management Working Group, GGF11 - The Eleventh Global Grid Forum, Honolulu, Hawaii USA, 6-10 June 2004.

### 3.6.2. Book Chapters

1. Gregor von Laszewski and Kaizar Amin. Grid Middleware, chapter Middleware for Communications, pages 109–130. Wiley, 2004. <http://www.mcs.anl.gov/~gregor/papers/vonLaszewski--grid-middleware.pdf>.
2. Geoffrey Fox, Shrideep Pallickara, and Marlon Pierce [Building a Grid of Grids: Messaging Substrates and Information Management](#) to appear as chapter in book "Grid Computational Methods" Edited by M.P. Bekakos, G.A. Gravvanis and H.R. Arabnia. Includes sections on OGCE component-based portals and portal services.

### 3.6.3. Conference Publications

1. Gregor von Laszewski and Mikhail Sosonkin. A Grid Certificate Authority for Community and Ad-hoc Grids. In 7th International Workshop on Java for Parallel and Distributed Computing, published in the Proceedings of the 19th International Parallel and Distributed Processing Symposium, Denver, CO, 4-8 April 2005. IEEE. <http://www.mcs.anl.gov/~gregor/papers/vonLaszewski-ca-workshop.pdf>.
2. Kaizar Amin, Gregor von Laszewski, and Armin R. Mikler. Toward an Architecture for Ad Hoc Grids. In 12th International Conference on Advanced Computing and Communications (ADCOM 2004), Ahmedabad Gujarat, India, 15-18 December 2004. <http://www.mcs.anl.gov/~gregor/papers/vonLaszewski-adhoc-adcom2004.pdf>.
3. Sangmi Lee Pallickara, Beth Plale, Scott Jensen, Yiming Sun, "Structure, sharing, and preservation of scientific experiment data", *To appear IEEE 3rd International Workshop on Challenges of Large Applications in Distributed Environments (CLADE)*, July 2005.
4. Sangmi Lee Pallickara, Beth Plale, Scott Jensen, Yiming Sun, "[Monitoring Access to Stateful Resources in Grid Environments](#)", *To appear IEEE International Conference on Services Computing*, July 2005.

5. L. Fang and D. Gannon, "XCAP - An Extensible Capability-based Authorization Infrastructure for Grids", 4th Annual PKI R&D Workshop: Multiple Paths to Trust, NIST Gaithersburg, MD April 19-21, 2005.
6. Shirasuna S., Slominski A., Fang L., and Gannon D., Performance Comparison of Security Mechanisms for Grid Services, the 5th IEEE/ACM International Workshop on Grid Computing, Pittsburgh, Nov. 8, 2004.pp. 360-364.
7. D. Gannon, S. Krishnan, L. Fang, G. Kandaswamy, Y. Simmhan, A. Slominski, On Building Parallel and Grid Applications: Component Technology and Distributed Services, Proceedings, Challenges of Large Applications in Distributed Environments (CLADE) In conjunction with the 13th International Symposium on High Performance Distributed Computing (HPDC-13), pp. 44-51, June, 2004. (To appear in a special issue of Cluster Computing.)
8. D. Gannon, S. Krishnan, A. Slominski, G. Kandaswamy, L. Fang, "Building Applications from a Web Service based Component Architecture", in In V. Getov and T. Kielmann, editors, Component Models and Systems for Grid Applications. Proc. of the Workshop on Component Models and Systems for Grid Applications, June 26, 2004 held in Saint Malo, France. Springer, 2005, to appear. ISBN: 0-387-23351-2.
9. M. Dahan, M. Thomas, E. Roberts, A. Seth, T. Urban, D. Walling, J. Boisseau. Grid Portal Toolkit 3.0 (GridPort). Proceedings of the 13th IEEE Intl. Symp. on High Perf. Dist. Comp, June, 2004.

#### **3.6.4. Journal Publications and Technical Reports**

1. M. Dahan, et. al. "Build grid portals with Grid Portal Toolkit 3," IBM DeveloperWorks. Paper last accessed on 31-May-05 at <http://www-106.ibm.com/developerworks/grid/library/gr-gridport/>.
2. Ahmet Sayar, Marlon Pierce, Geoffrey Fox [OGC Compatible Geographical Information Services](#) Technical Report (Mar 2005), [Indiana Computer Science Report TR610](#). This includes an early description of our GIS portal client work that is included in NMI Year 2 deliverables.
3. Mehmet Aktas, Galip Aydin, Andrea Donnellan, Geoffrey Fox, Robert Granat , Lisa Grant, Greg Lyzenga, Dennis McLeod, Shrideep Pallickara, Jay Parker, Marlon Pierce, John Rundle, Ahmet Sayar, and Terry Tullis [iSERVO: Implementing the International Solid Earth Research Virtual Observatory by Integrating Computational Grid and Geographical Information Web Services](#) Technical Report December 2004. This paper includes a description of application portal work based on Year 1 OGCE portal development.
4. D. Gannon, J. Alameda, O. Chipara, M. Christie, V. Dukle, L. Fang, M. Farrellee, S. Hampton, G. Kandaswamy, D. Kodeboyina, S. Krishnan, C. Moad, M. Pierce, B. Plale, A. Rossi, Y. Simmhan, A. Sarangi, A. Slominski, S. Shirasuna, T. Thomas, Building Grid Portal Applications from a Web-Service Component Architecture, Proceedings of the IEEE. Special Issue on Grid Technology, vol. 93. No. 3, 2005.
5. Eric Roberts, Steve Quinn, Michael Shapiro, Derek Simmel, Von Welch, Nancy Wilkens-Diehr "TeraGrid Account Management through the TeraGrid User Portal", Technical Report for the TeraGrid Requirements and Analysis Team, April 2005.

6. Beth Plale, Dennis Gannon, Yi Huang, Gopi Kandaswamy, Sangmi Lee Pallickara, and Aleksander Slominski, "Cooperating Services for Managing Data Driven Computational Experimentation", *submitted manuscript* 2005.
7. Beth Plale, Dennis Gannon, Dan Reed, Sara Graves, Kelvin Droegemeier, Bob Wilhelmson, Mohan Ramamurthy, "[Towards Dynamically Adaptive Weather Analysis and Forecasting in LEAD](#)", *To appear ICCS workshop on Dynamic Data Driven Applications*, Atlanta, Georgia, May 2005.
8. Beth Plale, Dennis Gannon, Jay Alameda, Bob Wilhelmson, Shawn Hampton, Al Rossi, and Kelvin Droegemeier [Active Management of Scientific Data](#) *IEEE Internet Computing special issue on Internet Access to Scientific Data*, Vol. 9, No. 1, pp. 27-34, Jan/Feb 2005.
9. Beth Plale, "[Framework for Bringing Data Streams to the Grid](#)", *Scientific Programming*, IOS Press, Amsterdam, Vol. 12, No. 4, 2004.
10. Gregor von Laszewski, Jarek Gawor, Pawel Plaszczak, Mike Hategan, Kaizar Amin, Ravi Madduri, and Scott Gose. An Overview of Grid File Transfer Patterns and their Implementation in the Java CoG Kit. *Journal of Neural Parallel and Scientific Computing*, 12(3):329–352, September 2004. Special Issue on Grid Computing. <http://www.mcs.anl.gov/~gregor/papers/vonLaszewski-overview-gridftp.pdf>.

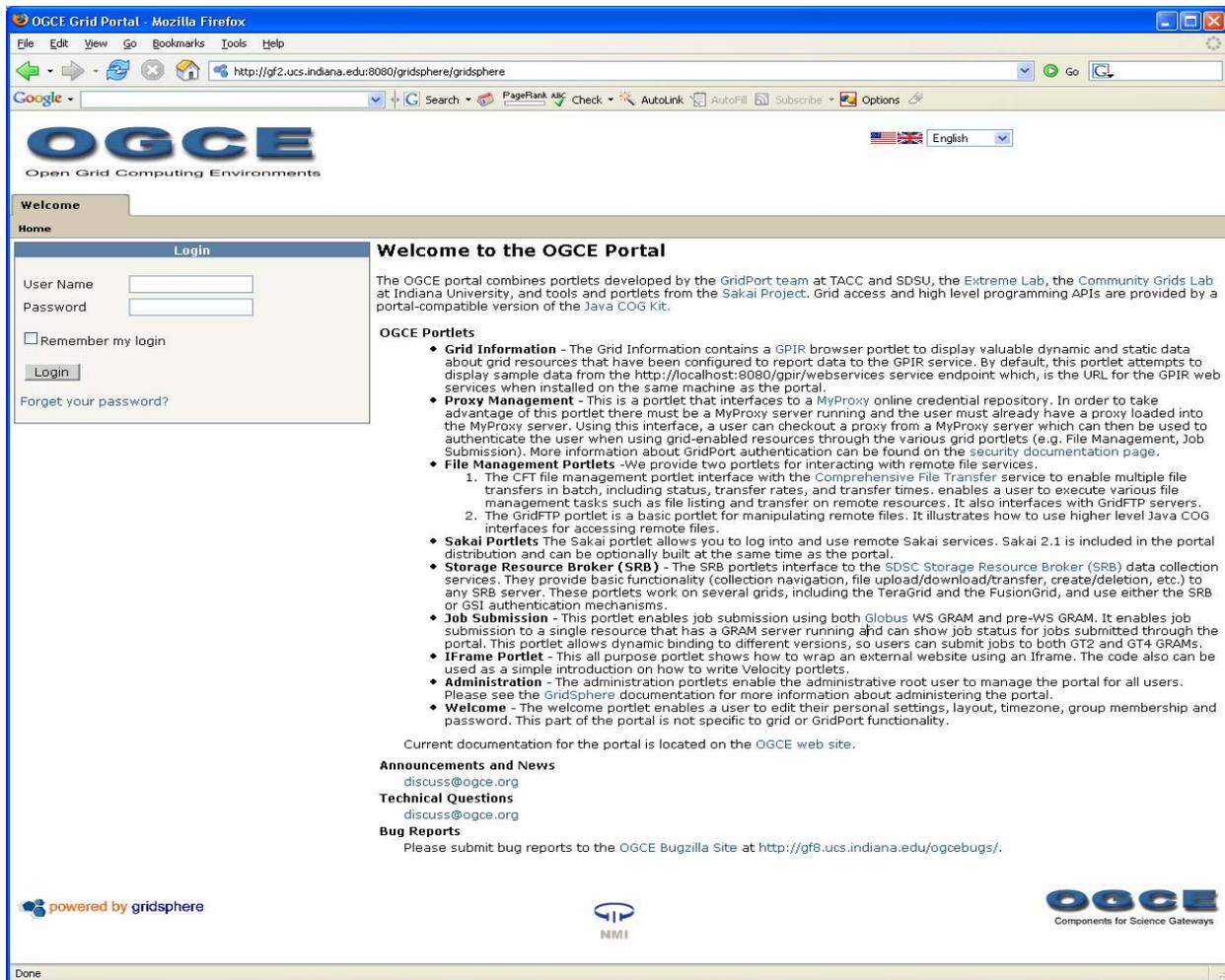
### 3.6.5. Posters

1. Gregor von Laszewski, Grid Programming Patterns with the Java CoG Kit 4. GlobusWorld, Boston, Massachusetts, 7-11 February 2005.
2. Gregor von Laszewski. Workflow support in the Java CoG Kit 4. Boston, Massachusetts, 7-11 February 2005.
3. Marlon Pierce, et al., The Open Grid Computing Environments Project. *Supercomputing 2004*, Pittsburg, 6-12.
4. Gregor von Laszewski, Kaizar Amin, Matt Bone, Mike Hategan, Pankaj Sahasrabudhe, Mike Sosonkin and Robert Winch, Nithya Vijayakumar, and David Angulo. The Next Generation of the Java CoG Kit (Version 4). *Supercomputing 2004*, Pittsburgh, 6-12 November 2004. (Refereed Poster) Best poster award. <http://www.sc-conference.org/sc2004>.
5. Mihael Hategan, Gregor von Laszewski, and Kaizar Amin. Karajan: A grid orchestration framework. *Supercomputing 2004*, Pittsburgh, 6-12 November 2004. (Refereed Poster).<http://www.sc-conference.org/sc2004>.
6. Kaizar Amin and Gregor von Laszewski. High-Level Grid Execution Patterns. In 6th International Workshop on Distributed Computing, Calcutta, India, December 2004.

## 4. Year 3 (2005-2006) Project Overview and Highlights

Highlights of the OGCE project in Year 3 included the following:

- A complete revision of the main portal download enables users to build and deploy the portal in a single download.
- Several additional portlets were developed, including SRB, Condor, and Sakai portlets.
- OGCE software was used to build a number of portals, including the LEAD and RENCIBioportal TeraGrid Science Gateways as well as the TeraGrid User Portal.
- The OGCE website was revised to be more easily navigable and maintainable.



**Figure 8: The base OGCE portal download includes portlets for managing grid credentials, running jobs, manipulating files, monitoring resources, and collaborating with other users. These are integrated into a single build.**

For Year 3, one of our primary deliverables was to actively engage and assist the science portal community in building OGCE compatible portals. This effort was highly successful and resulted in a number of fruitful collaborations. Details are given in the deliverables section, but we highlight several below.

Figure 8 shows the entry page of the OGCE portal following its revised build and deploy process, developed by TACC and IU. The OGCE has contributed to numerous portals and science gateways, as we illustrate in Figure 9-14.

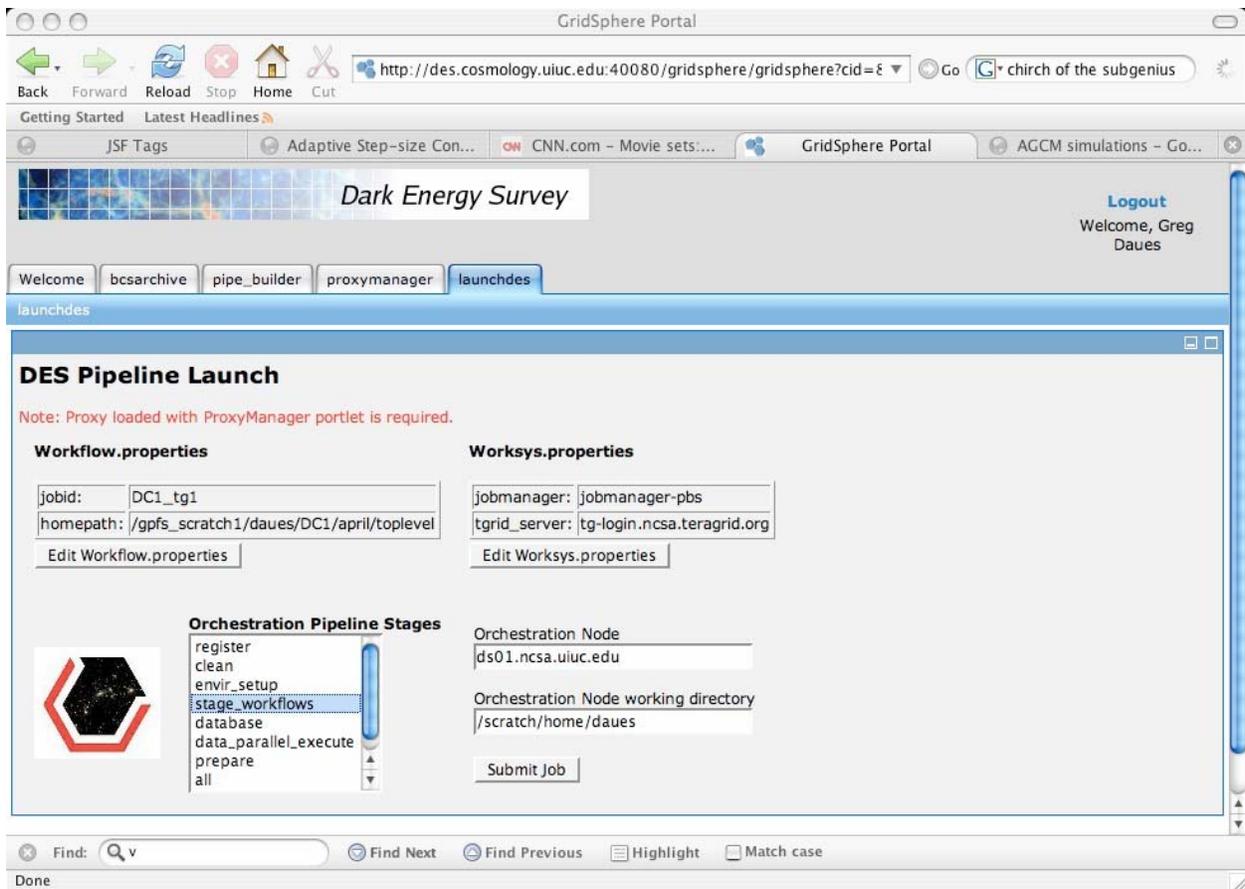


Figure 9: Dark Energy Survey portal, built by Greg Daues (NCSA) using NCSA's OGCE Grid Tools.

GridSphere Portal

Back Forward Reload Stop Home Cut

http://tb1.ncsa.uiuc.edu:11080/gridsphere/gridsphe

Getting Started Latest Headlines

GridSphere P... Lyrics of hindi s... rates.html Index (Java Glo... Bollywood Blitz ... Neutron stars

Welcome ncsaeventviewer JSF sample portlets proxymanager-portlet

NCSAEventViewer

### Job Events

Focus on Ensemble: DC1\_A3 Refresh Ensemble TeraGrid View Return

ensembleId	workflowId	nodeId	creationTimestamp
DC1_A3	Main	End component data_parallel_execute on DS01	Sat Feb 18 11:31:42 CST 2006
DC1_A3	012_2006Feb18	End Processing ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:31:03 CST 2006
DC1_A3	012_2006Feb18	End Stage_moveproduct for ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:31:03 CST 2006
DC1_A3	012_2006Feb18	End Stage_runadaptive for ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:31:03 CST 2006
DC1_A3	012_2006Feb18	End Stage_runcat for ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:25:02 CST 2006
DC1_A3	012_2006Feb18	End Stage_astrometry for ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:21:43 CST 2006
DC1_A3	012_2006Feb18	End Stage_runimcorrect for ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:19:13 CST 2006
DC1_A3	012_2006Feb18	End Stage_createflatfits for ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:18:23 CST 2006
DC1_A3	012_2006Feb18	End Stage_createbiasfits for ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:16:25 CST 2006
DC1_A3	012_2006Feb18	End Stage_overscan for ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:16:12 CST 2006
DC1_A3	09_2006Feb18	End Processing ccd 09 data on tg-c256.ncsa.teragrid.org	Sat Feb 18 11:16:03 CST 2006
DC1_A3	09_2006Feb18	End Stage_moveproduct for ccd 09 data on tg-c256.ncsa.teragrid.org	Sat Feb 18 11:16:03 CST 2006
DC1_A3	09_2006Feb18	End Stage_runadaptive for ccd 09 data on tg-c256.ncsa.teragrid.org	Sat Feb 18 11:16:02 CST 2006
DC1_A3	012_2006Feb18	End Stage_copybpm for ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:15:23 CST 2006
DC1_A3	012_2006Feb18	End Stage_moveraw for ccd 12 data on tg-c343.ncsa.teragrid.org	Sat Feb 18 11:15:22 CST 2006
DC1_A3	011_2006Feb18	End Processing ccd 11 data on tg-c033.ncsa.teragrid.org	Sat Feb 18 11:15:11 CST 2006
DC1_A3	011_2006Feb18	End Stage_moveproduct for ccd 11 data on tg-c033.ncsa.teragrid.org	Sat Feb 18 11:15:11 CST 2006

Done

**Figure 10: Large Synoptic Survey Telescope portal, showing job monitoring portlet. Built by Greg Daues, NCSA.**

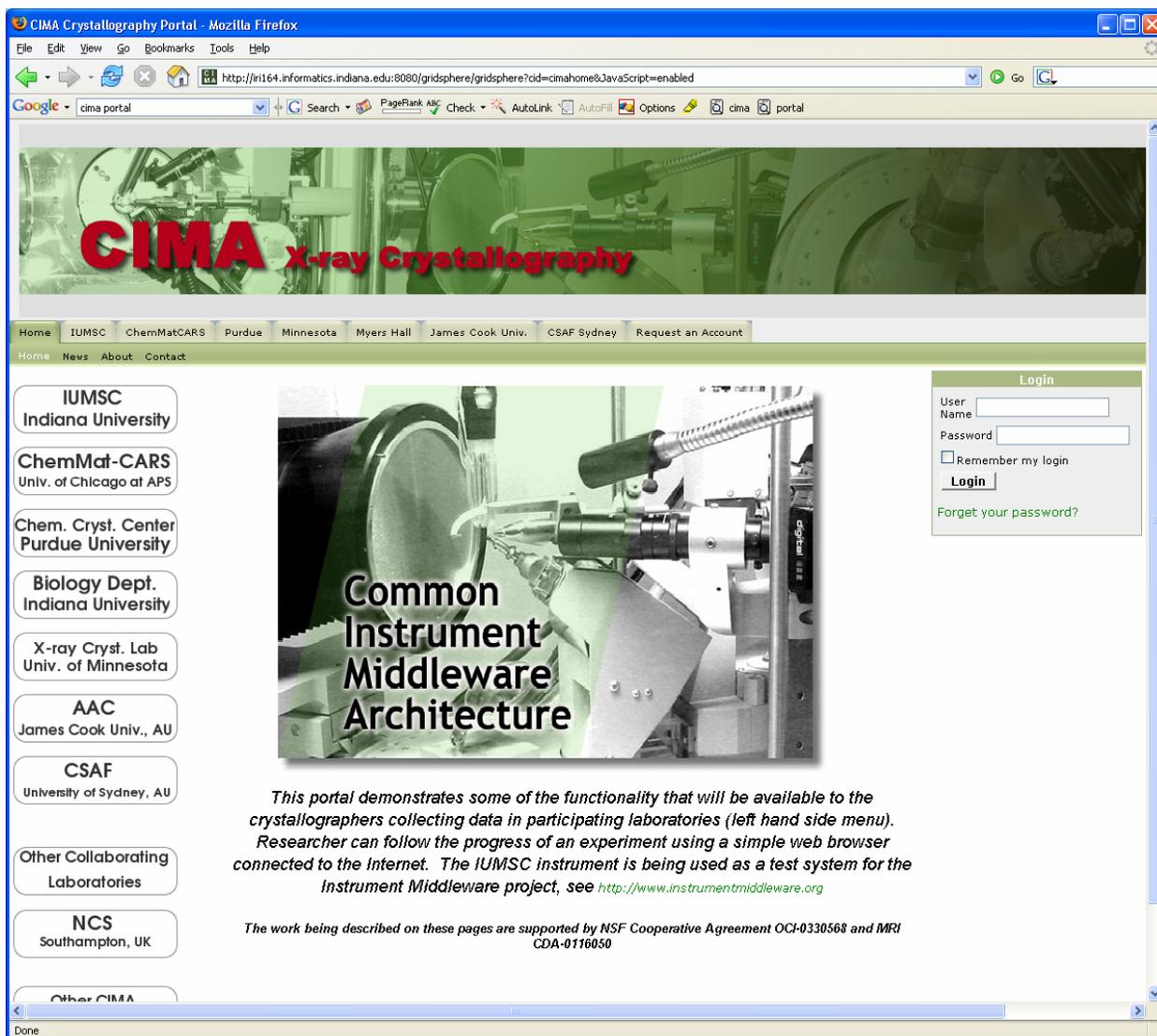


Figure 11: CIMA crystallography portal, built by Hao Yin, Mehmet Nacar in collaboration with Rick McMullen's NMI-funded CIMA project.

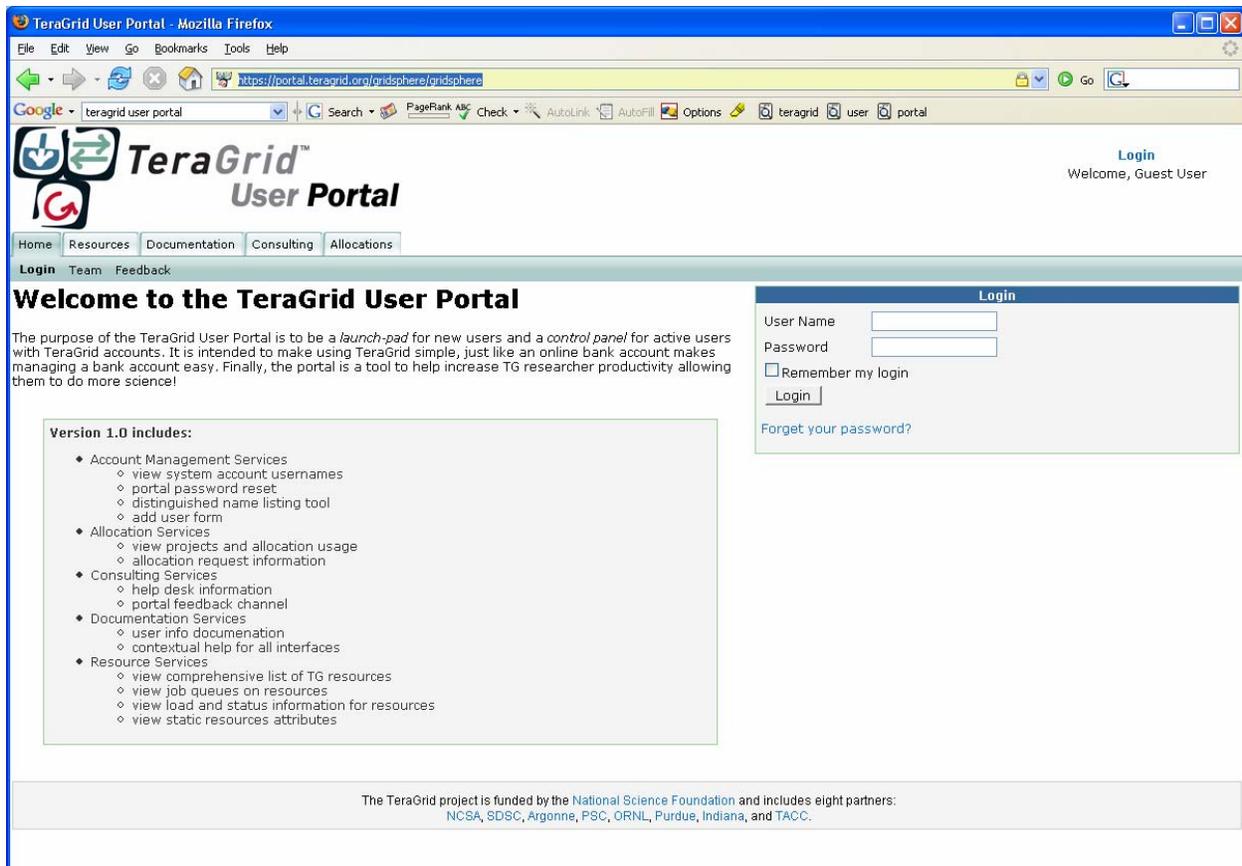


Figure 12 TeraGrid User Portal, built by Eric Robert of TACC.

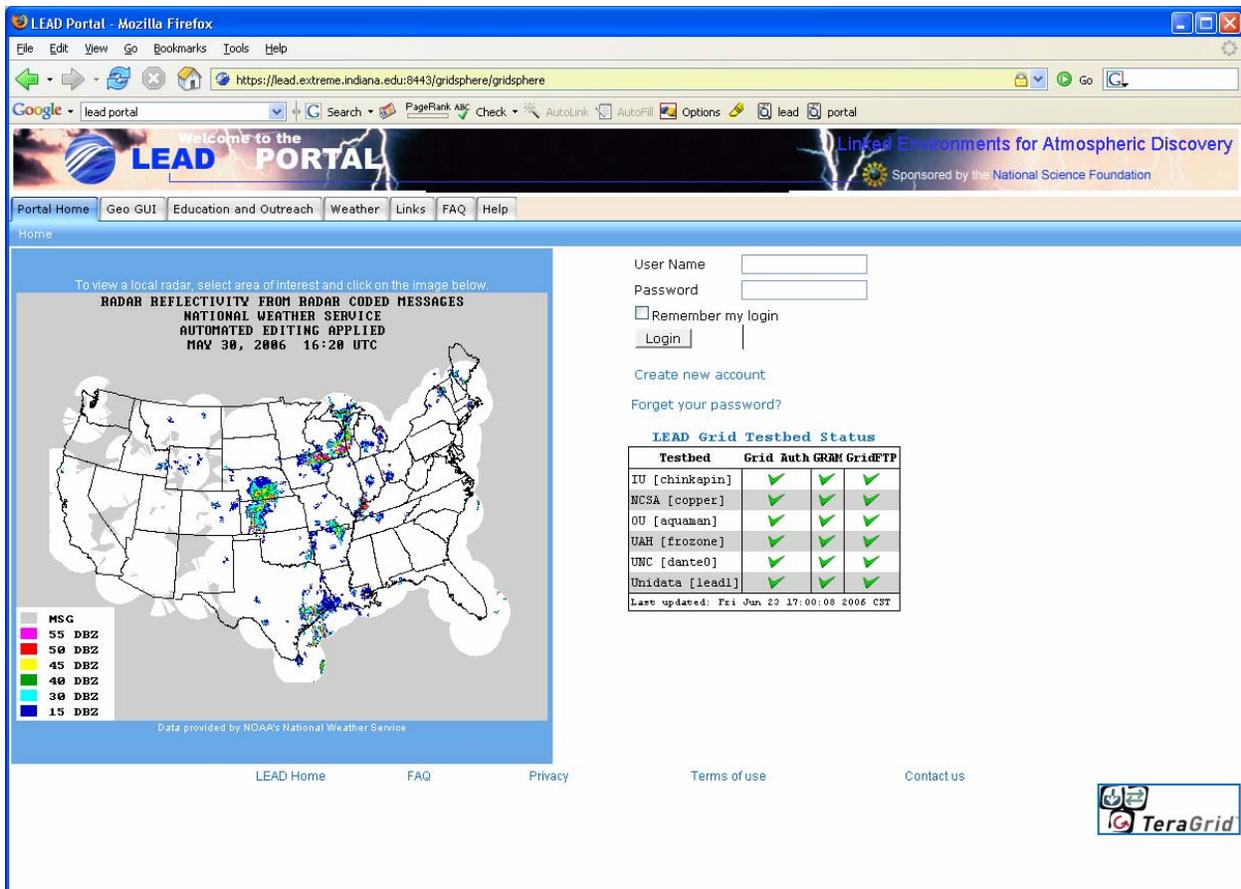


Figure 13: LEAD Portal, a TeraGrid Science Gateway built by Marcus Christie, Suresh Marru, and other members of the Indiana University team using OGCE software.



Figure 14: RENCI Bioportal, a TeraGrid Science Gateway developed by the RENCI team at the Renaissance Computing Center using OGCE software.

## 4.1. Collaborations

Our Year 3 activities and deliverables included direct support for collaborating groups. These are extensively described in section 4.2.1 below. In addition to these direct collaborations, we provide support and maintain collaboration with several portal groups around the world through our mailing lists. A sample list is available through <http://www.collab-ogce.org/ogce2/ogce-portals.html>.

## 4.2. Activities and Findings

### 4.2.1. Supporting Collaborative Communities

Activity	Description
NMI CIMA Portal Development and Support	The OGCE interacts very closely with the NSF NMI funded CIMA project to develop the CIMA Crystallography portal. This portal was designed and built by M. Nacar, H. Yin, and M. Pierce (all from IU) in direct collaboration with the CIMA team. This collaboration has led to the current production version of the CIMA crystallography portal and its packaging for distribution at CIMA collaboration sites. We have also submitted a joint paper on this project to GRID 2006.
VLAB Portal Support	The OGCE team is helping to develop the VLAB portal to support the NSF ITR-funded Virtual Laboratory for Earth and Planetary Materials. This effort is led by M. Pierce and includes the development of Grid Faces tag libraries by M. Nacar to simplify Grid portlet development. This effort was described in our joint submission to the GCE 2005 Workshop; see “Conference Publications” below for bibliographic information. VLAB has recently been added to the TeraGrid Science Gateways.
LEAD	The OGCE has provided the foundation for the LEAD Portal that is being deployed as part of the “Linked Environments for Atmospheric Discovery – an NSF large ITR. This project is building tools that are designed to enable adaptive, real-time prediction of Tornados and Hurricanes and a platform for experimental research in atmospheric science.
Teragrid	The OGCE project has provided portal frameworks and tools that are used extensively throughout the Teragrid Gateway project. This includes the LEAD gateway, the Teragrid User Portal, the RENCIBioportal and the Texas Flood modeling gateway.

## 4.3. Deliverables

### 4.3.1. Project-Wide Software Deliverables

We worked this year to develop higher level programming interfaces for grid portal development. Our tools of choice are based on Java Server Faces (JSF), JSF/JSP tag libraries, and Java Beans. All of these tools wrap the Java COG Kit. Java Server Faces was chosen, among other reasons,

for its clean separation of backing code from the Servlet API. Completion percentage gives the project status at the end of Year 3.

Group	Grid Server Faces (GSF) Deliverable	Completion %
Indiana, Chicago	Integration of CoG Karajan XML markups into GSF to support workflow descriptions.	95%: We developed JSF TaskGraph libraries and sample user interfaces. These wrap the CoG's taskgraph workflow system. We have integrated this with the VLAB and CIMA portal projects for field testing and are examining its use for the LSST/Dark Energy portal work. We will package this for general release before the close of Year 3.
Indiana	Abstract data models for MyLEAD/OGSA-DAI and GridFTP	90%: GridFTP abstractions are included in the TaskGraph libraries. We developed prototype MyLEAD/OGSA-DAI models.
SDSU	GridPort 4 portlets: SRB, GPIR developed using abstract data models and portlet display components. AJAX investigations.	SRB v1 90% complete, still need to add meta data; all portlet use AJAX technologies - ongoing; GPIR portlet redesign to use WSRF 30% complete.
TACC	GridPort 4 portlets: GPIR, GRAM Job Submission, Comprehensive File Transfer, Condor Job Submission. Use of reusable interface components throughout these portlets.	All Portlet functionality is 100% complete, adding automatic testing capabilities for each GridPort portlet is ongoing and expansion of maven targets for simple install and deployment is ongoing as well.
NCSA	Tupelo tag libraries for inclusion in task graph libraries.	This deliverable is delayed due to substantial architectural change for Tupelo 2.0 (which is no longer a grid service, but rather a toolkit for managing data across heterogeneous services, with standard service front-ends). As this work matures, exactly what tag libraries need to be built will become clearer.
Chicago	Globus Toolkit integration and testing	70% complete. The Globus Toolkit is steadily evolving and has changed several times its protocols and APIs. We have provided abstractions that make is much more simple to use Grid

		infrastructure for portal developers.
UM	To the extent possible move Sakai tools from Velocity to JSF. Work with uPortal to insure strong support for the JSF-JSR-168 connector.	The activity and effort to port Sakai tools from Velocity to JSF was altered to focus on WSRP efforts. The Sakai Velocity tools currently have better support for WSRP than the JSF tools. WSRP support for Sakai was included as a provisional capability in the Sakai 2.1 release in December 2005. The provisional WSRP support needs further work before it is production ready. Part of the problem is the poor cross-vendor interoperability of WSRP and lack of WSRP support for the current primary OGCE portal (GridSPHERE). Because of this we have focused more effort on the Sakai JSR-168 portlets which work well across many portal containers.

#### 4.3.2. Project Wide Technical Outreach Deliverables

Our major deliverable in Year 3 was based on outreach and support for various collaborating portal communities. This is summarized below (table taken from Year 2 annual report).

Grid Portal Project	Project Lead	OGCE Developer(s)	Deliverable	OGCE Feedback	Completion %
TeraGrid User Portal	Charlie Catlett, ANL (catlett@mcs.anl.gov)	TACC: Eric Roberts, Maytal Dahan (Other non-OGCE funded: Jay Boisseau, Patrick Hurley)	Use OGCE as base install, meet TeraGrid security requirements.	OGCE inherits TeraGrid security framework and user tools, including portal single sign-on and potentially PURSe.	100%: Portal is available at <a href="http://portal.teragrid.org">http://portal.teragrid.org</a>
TeraGrid LEAD Portal Gateway	Kelvin Droegemeier, University of Oklahoma (kkd@ou.edu)	Indiana: Dennis Gannon, Beth Plale, Marcus Christie,	Metadata directory service; workflow and experiment	OGCE inherits LEAD advanced services for	100% for portal. Application factory services, workflow tools and metadata

		Sangmi Lee	builder portlets; case-based reasoning portlets.	science application and data management.	management tools are currently being packaged for OGCE release.
SCEC Portal	Reagan Moore, SDSC (moore@sdsc.edu)	SDSU: Mary Thomas, Ray Regno	SRB portlet integration to support the digital libraries project.	Field tested SRB portlets given back to other developers like the European Data Grid.	100%. SRB portlets were contributed back to OGCE and are in the current release.
TeraGrid TGviz Portal Development	Mike Papka, Joseph Insley, Argonne National Labs (papka@mcs.anl.gov)	Chicago: Gregor von Laszewski	Assist in the use of the OGCE portal technology.	OGCE gains valuable deployment experience by supporting this group. Portlets for integration with native applications.	
NMI CIMA Project	Rick McMullen, Indiana University	Indiana: Marlon Pierce, Mehmet Nacar	Develop core Grid infrastructure and Geographical Information System portlets and services to support the NMI Sensors Project. This will leverage Year 2 deliverables.	OGCE inherits Sensor project's advanced authorization schemes and gets customers for its GIS portlets.	100%: CIMA portal converted to JSR 168 framework by OGCE developers and is in deployment. CIMA-OGCE collaborators also have deployed the CIMA portal for Australian university collaborators.
VLAB	Renata Wentzcovitch (wentzcov@ce.ms.umn.edu)	Indiana: Marlon Pierce, Mehmet Nacar	Develop portlet services to manage molecular	The VLAB project has close connections with	100%: The VLAB portal is currently running at <a href="http://kamet.ucs">http://kamet.ucs</a>

			dynamics simulations.	European Data Grid members. We can test our workflow and SRB portlets on new applications.	.indiana.edu:8080. Portlets were built using Grid Server Faces libraries developed by Nacar. Computational resources include both TeraGrid and non-TeraGrid resources.
TeraGrid Flood Modeling Gateway	Bill Barth, bbarth@tacc.utexas.edu	TACC: Maytal Dahan	Develop portal interface to Flood Modeling application backend using OGCE portal technology	OGCE inherits interfaces and tools.	100%: Initial prototype is complete and has been previewed by users for further evaluation and requirements gathering
TIGRE User Portal	TACC, Texas A&M University, Texas Tech, Rice, University of Houston	TACC: Maytal Dahan	Use OGCE as base install, meet TIGRE security requirements.	OGCE inherits grid application interfaces and tools	100%: The TIGRE portal is available from <a href="http://tigreportal.hipcat.net">http://tigreportal.hipcat.net</a>
LSST and Dark Energy Portals		NCSA: Jay Alameda and Greg Daues	Uses OGCE grid tools developed at NCSA	OGCE tools tested in production environment	Ongoing collaboration, prototype completed
MAEViz Portal		NCSA: Joe Futrelle	Uses NCSA Tupelo services.	Portlet tag libraries for accessing Tupelo services	Ongoing collaboration.
ReDReSS (Resource Discovery for Researchers in e-Social	Dr. Robery Crouchley (r.crouchley@lancs.ac.uk)	Umich: Charles Severance	Provide support for integrating Sakai and uPortal as well as technical	Work Complete	<a href="http://esc.dl.ac.uk/Sakai/">http://esc.dl.ac.uk/Sakai/</a>  <a href="http://redress.lancs.ac.uk/">http://redress.lancs.ac.uk/</a>

Science)			guidance on tools being developed for the researchers.		
NanoHub	Dr. Krishna Madhavan (cm@purdue.edu)	Umich: Joseph Hardin, Charles Severance	Provide support to integrate Sakai into the nanohub's Mambo-based portal.	Work complete.	<a href="http://www.nanohub.org/">http://www.nanohub.org/</a>
NEESit	Dr. Yael "Lelli" Van Den Einde ( <a href="mailto:lellivde@sdsc.edu">lellivde@sdsc.edu</a> )	UMich: Beth Kirshner	Port NEESGrid software from CHEF to Sakai. Investigate the application of OGCE technologies for NEESit	The OGCE work was completed and is available to the NEES community. The NEESit team chose to rebuild the NEES software infrastructure without using portal technology.	<a href="http://it.nees.org/">http://it.nees.org/</a>
DOE Blue Gene	Susan Coughlan	Gregor von Laszewski	Experimental interfaces to the Cobalt Queuing system	We are evaluating the possibility of designing portable Queue Monitoring portlets for Cobalt	Completed: 5%

#### 4.3.3. University of Chicago Deliverables

Description	Completion %
Develop a service to access Karajan Workflows	We have delivered a prototype using gridmap technology. Completed 80%
Develop a portlet to access the Karajan Workflow	Integration with myproxy needs to be completed. Completed 0%.

Investigate the possibility to integrate the GUSS portlets into the OGCE release	Due to a redesign GUSS this activity has been assessed no longer necessary. However, we did complete the activity to 100%. It has been transitioned to dev.globus and Lee Liming is now extending our original work
Work together with the UC TeraGrid group to assist in reusing OGCE technology	As part of the overall team we have communicated with several members of the team and as collective success TG has adopted OGCE.
Maintain the Java CoG Kit and enhance it for upcoming changes to the Globus Toolkit.	This work took most of our time as again many changes took place in the Globus toolkit. We prevented that the whole team needed to modify the software on several places. Instead the modifications were captured by us and through the reuse almost no changes were necessary. Outstanding tasks are a) integration with RLS b) integration with MDS. The MDS was not available till recently in production form. It also played a minor role in this project as GPIR was available to us. Completed 80%
Develop a testing framework for the Java CoG Kit.	We have developed a testing Framework for job submission and gridftp. It is to 100% complete and included as part of the Java CoG Kit Karajan workflow. However it needs to be deployed and tested on production grids such as TG and VOMS. This task has not yet started.
Release a new version of the Java CoG Kit for OGCE with maven integration.	We have released a new version of the Java CoG Kit that includes jar files that can be picked up from maven based installers. 100% completed. As part of this development, we are evaluating if a transition to an entire maven based install process would be of benefit for the Java CoG Kit. This task has not yet been started, as the solution provided by us proved sufficient for the OGCE project.
<b>Additional Deliverables</b>	
Maintenance of source code repositories	100% completed

#### 4.3.4. Indiana Deliverables

Description	Completion %
Assist TACC with investigation of PURSE for credential registration.	Completed. PURSe portlets were developed and released through OGCE. TACC

	investigation completed but system was not used in production user portal.
Investigate more portal services and lightweight containers for display services, content management.	100% We implemented client tag libraries for Indiana University's WS-Context as a lightweight metadata management system. This was performed in collaboration with the NSF-funded VLAB collaboration.
Maintenance and enhancement of existing components: GlobalMMCS clients, and GIS client portlets and services.	50% GIS portlets were integrated into QuakeSim Earthquake portal; GlobalMMCS server side undergoing complete revision so associated portlet development is on hold.
Application factory service for wrapping legacy code as a web service	100%. Used in the LEAD portal and adopted for use by the Renci Bioportal. Basis for PhD thesis by Gopi Kandaswamy (defended June 2006)
Capability manager – a web service framework for authorization based on a capability token system	100%. Used in the LEAD portal. Basis for Ph.D. thesis by Liang Fang (defended May 2006)
Geo Search Portlet – a portlet that allows query formation based geographic regions selected by the user from a map.	100% Used as one of the input modes on the LEAD portal.
MyLEAD metadata directory portlet – a metadata directory browser.	90% Alpha test in progress. (2006)
Experiment Builder Portlet – a tool to configure the inputs to a workflow and store experimental metadata in MyLEAD	90% Alpha test in progress (2006)
Workflow composer – an applet/webstart application that allows users to graphically compose workflows for execution with a BPEL-based workflow engine	70% Alpha test to begin in Aug 2006
<b>Additional Deliverables</b>	
PURSe portlet development	100%: This was completed and the release is linked through the OGCE web site.
OGCE Web Site revision	100%: This was completed by TACC and IU.
OGCE software build system revision	100%: This was completed by TACC and IU.
Portlet and tag library development	100%: We developed portlet and tag library interfaces for interacting with WS-Context services for metadata management.

#### 4.3.5. University of Michigan Deliverables

Description	Completion %
Work with the rest of the OGCE team to produce an OGCE release in Year 3 which includes Sakai Collaboration tools out of the box. There is a great deal of effort involved in	This was completed. The JSR-168 portlets are part of the OCSE2 release and also part of the Sakai out of the box release as of Sakai 2.1 in December 2005. These portlets work

<p>this deliverable as it involves adding WSRP and then JSR-168 capabilities to Sakai and then performing the uPortal integration so that Sakai tools naturally appear as uPortal channels.</p>	<p>with uPortal, GridSphere, and other JSR-168 portals. WSRP Producer support is available in Sakai 2.1 as well. The JSR-168 Sakai portlets are in use at a number of sites - because of interoperability problems, WSRP deployment and use has not happened to date.</p>
<p><b>Additional Deliverables</b></p>	
<p>Participate in the JSR-286 Expert Group</p>	<p>Charles Severance is a member of the JSR-286 portlet specification version 2.0 group. This group is meeting throughout 2006 and hopes to deliver the specification sometime on 2007. The 286 specifications will significantly improve the portlet interface and be highly coordinated with the WSRP 2.0 effort as well.</p>
<p>Internationalize Sakai</p>	<p>This has been an ongoing effort since early in 2005. Sakai is now available in seven languages with more languages coming soon. The primary activity has been to coordinate the localization activity and make changes to Sakai to better support internationalization. As an example, Sakai in the current release now allows each user to have a different language. Prior versions of Sakai only supported one language for an entire Sakai site.</p>
<p>Use the NMI Testbed to Test the Sakai Builds</p>	<p>This is 25% complete. Initial work was completed by the builds are not yet automated.</p>
<p>Liason to the Fedora User Community</p>	<p>This is ongoing activity led by Beth Krishcner. The goal is to exchange data between Fedora and Sakai. To date, this has resulted in some prototype software and attending the Sakai and Fedora User's meetings and directing Birds of a Feather Sessions.</p>
<p>Liason to the uPortal / JA-Sig community</p>	<p>Charles Severance is now a member of the Sakai Foundation board of directors that meets regularly with the JS-Sig board of directors to coordinate cross-project activity. We have attended uPortal developer meetings and conferences as well to maintain the relationship.</p>

#### 4.3.6. NCSA Deliverables

Description	Completion %
Tupelo 1.1 release -- September 30, 2005. New features will include full RDF-OWL import/export, optimized Oracle support.	100%
Will port Tupelo from OGSi 3.2.1 to WSRF or other GSI-supporting Web Services framework.	Not applicable. Tupelo 2.0 is no longer a grid service.
JSF-based Tupelo administration portlet	Not applicable. Plans for an administration portlet have been dropped.
Tupelo-based archiving support for molecular dynamics applications in collaboration with Scott Parker/NCSA and the NANOGROMACS project.	With the change in architecture for Tupelo 2.0, this deliverable has been deferred and will be revisited as to its future applicability.
Job Broker – developed in collaboration with LEAD ITR. Further refinement of desktop components and remote OGRE portlets	50% We have a prototype service and desktop components available at <a href="http://torcida.ncsa.uiuc.edu:8080/confluence/dashboard.action">http://torcida.ncsa.uiuc.edu:8080/confluence/dashboard.action</a>
Further refinement of data-service integration, in support of advanced applications (in collaboration with LEAD and with Scott Parker)	50% We have adopted an enterprise service bus, ActiveMQ, as the hub for our data/event/logging systems, using RDF Triples as the payload for the JMS messages. This facilitates further integration with advanced data services such as Tupelo2 and MyLead, as well as opens opportunities to interact with other messaging systems (e.g., WS-Eventing systems)
<b>Additional Deliverables</b>	
NCSA hosting RENCi Biportal	100% <a href="http://biportal.ncsa.uiuc.edu">http://biportal.ncsa.uiuc.edu</a>

#### 4.3.7. San Diego State University Deliverables

Description	Completion %
GridPort4 development, including GP portal bundle (w/TACC)	100%. GridPort 4.1 release was completed including SRB portlet integration, Note: In April, 2006, the GridPort and OGCE frameworks were merged into a single toolkit. This had some impact on deliverables, and is addressed below.
Automating portal configurations using Web	GridPort and OGCE frameworks have been

portal interface (w/TACC)	merged, and this project is no longer needed
Portals: SCEC, Fusion Data Grid Portal	The SCEC portal is 100% completed and in daily operation. The Fusion portal demonstration was 100% completed and turned over to the Fusion Grid project for development. Note: the FG project ended in 2006, and is undergoing review for extension.
Portlet Interfaces: SRB/Data, Geophysics viz/sensor.	The SRB portlets are 100% complete, including AJAX technologies, and interfaces to WSRF based services. The Geophysics portal was never funded.
Technology Investigations: AJAX/CSS, WSRF/GT4, Performance	AJAX for SRB portlets – 100% complete. Continuing to work with WSRF services.
<b>Additional Deliverables</b>	
Python portal frameworks	SDSU investigated both the Zope and the TurboGears portal frameworks as interfaces to the WSRF based PyGlobus Toolkit. However, neither of these frameworks was easily modified for grid portals.
SDSU Flame Grid, Bio Grid, Ocean Modelling projects	Working with SDSU researchers to develop WSRF services and portal interfaces to these research projects. These efforts will continue through 2007.

#### 4.3.8. Texas Advanced Computing Center Deliverables

Description	Completion %
GP4 development, including GP portal bundle (w/SDSU)	100%: GridPort 4.1 is currently release and has been downloaded by a variety of users. The bundle includes various job submission, file management, GPIR and SRB portlets and has a demo portal and quick start download for simple install and configuration.
Automating portal configurations using maven (w/SDSU)	100%: A GridPort maven plugin has been developed to automate the configuration and installation of the portlets into a fully functional demo portal.
Portals: TeraGrid, TIGRE, SURA, and TACC	100%: The TeraGrid, TIGRE, SURA and TACC portal are all in production and based on GridPort technology.
Portlet interfaces: general bioinformatics, remote visualization	50%: Developed alpha quality remote visualization portlet interface that interfaces with the TeraGrid visualization resource Maverick and is part of the Flood Modeling Gateway prototype
Technology Investigations: Advanced Maven	33%: Utilized many different performance

capabilities, performance, WSRF/GT4	enhancement techniques for the TeraGrid User Portal including load balancing of multiple Tomcat web servers, database connection pooling, and load testing with JMeter.
<b>Additional Deliverables</b>	
Assisted international collaborators with development of portlet interfaces to computational chemistry applications	100%: helped with design and architecture of Gaussian and NWChem portlets for submitting jobs and visualizing output. Collaborators used GridPort 4 as basic portal for development.

#### 4.3.9. Community Service and Outreach Deliverables

Description	Completion %
Organize and lead the restarted Grid Computing Environments (GCE) group in the GGF. We will lead meetings at GGF 14-16.	100%: We organized a GCE meeting at GGF 14. For GCE 15 we organized a portal workshop. Details are available from <a href="http://www.collab-ogce.org/GGF15Workshop/">http://www.collab-ogce.org/GGF15Workshop/</a> . Instead of GGF 16, we organized the GCE 2005 workshop at SC2005.
Continue to participate in GGF at all levels (on steering committees, in related working groups such as SAGA).	100%
Continue our participation in the TeraGrid Science Gateway projects.	100%: The TeraGrid portal came on line in May 2006. The LEAD portal is one of the 10 initial science gateways, and the VLAB portal was recently added.
Participate actively in Supercomputing 2005. We will give OGCE and related demonstrations at various booths. We will also submit posters and tutorials.	100%: We organized several demos at TACC, IU, NCSA, and Argonne booths. We also organized the GCE 2005 workshop.
Pursue Grid portal tutorial opportunities: we have applied to do a tutorial at Supercomputing	100%: We gave tutorials at GGF 15 and the Tapia conference.
If selected, write a book on Grid Portal development. Gannon and Pierce have submitted a proposal to Elsevier that involves members of the OGCE and others in the community.	100%: The book was accepted for publication. Editors Gannon & Pierce have completed the outline and have collected rough drafts of all chapters. Most PI's and senior personnel from OGCE are contributing authors.
Write and submit articles to appropriate peer-reviewed Grid computing journals.	100%: Our description of the OGCE project was accepted for publication in the special "Science Gateways" issue of <i>Concurrency and Computation: Practice and Experience</i> . Other

	<i>publications are described below.</i>
Continue to build grid program at SDSU by teaching follow-on grid computing class in Spring 2006.	This class was delayed due to funding and time limitations, but has been rescheduled for Spring 2007.
<b>Additional Deliverables</b>	
I533 Seminar Course for Indiana University School of Informatics	Pierce, Plale, and Fox gave lectures in this series. Topics included Grid technology, Portals and Portlets, Web Services, and data management services, and e-science.

## 4.4. Products, Software, and Websites

### 4.4.1. OGCE2 Portal

The OGCE2 series of software releases is based on the JSR 168 portlet standard and is distinguished from our OGCE1 series in Year 1.

**Version 1.0 Release:** We released JSR 168 versions of our Grid portal suite, including GPIR, GridFTP, Job Submission, and Proxy Management. These portlets used the portal-compatible Java CoG 4.x series to provide support for Globus Toolkit version 2.4 and 4.0 releases. Versions 1.0.0, 1.0.1, and 1.0.2 were released during Year 2. Additional information is available from <http://www.collab-ogce.org/ogce2/ogce2-1.0-download.html>.

**Version 2.0 Release:** Led by the TACC and Indiana teams, we completed a major revision of our installation and packaging system. The current OGCE2 2.0 release includes all software (both OGCE, GridPort, and third party tools such as Sakai and GridSphere) needed to set up a Grid portal and Science Gateway in a single installation package.

In addition to the core Globus Toolkit portlets we have developed in OGCE2 1.0, the 2.0 release also contains several new portlets including

- Storage Resource Broker portlet.
- Condor portlets: these work with Condor 6.7's BirdBath SOAP/WSDL enabled services.
- Sakai bridge portlets: these use Web Services to manage connections between the Sakai portlet and remote Sakai services.

### 4.4.2. Tupelo Metadata Services Releases

Tupelo v1.1 was released on September 30, 2005 (available at <http://dlt.ncsa.uiuc.edu/wiki/index.php/1.1>), and includes OWL export, optimization of Oracle and MySQL, and support for ssh-based data transfers. No further 1.x releases are planned, due to the architectural changes for v2.0

Tupelo v2.0 pre-release was made available as a preview at [http://dlt.ncsa.uiuc.edu/wiki/index.php/Tupelo\\_2](http://dlt.ncsa.uiuc.edu/wiki/index.php/Tupelo_2) during this period. Tupelo 2 is no longer a grid service, but rather is a toolkit for managing data across heterogeneous services, with standard service front-ends. Tupelo 2 is implementing the JSR-170 Java Content Management standard.

We have a sample JSP application that merges information from 2 URIQA services; these examples will be ported to JSF.

#### 4.4.3. PURSe Portlets Release 1.0

The PURSe Portlet system works as a client interface to the NMI PURSe Grid credential account management system. These portlets were designed using Java Server Faces as part of our Grid Faces project. Additional information is available here: <http://www.extreme.indiana.edu/portals/purse-portlets/index.html>.

#### 4.4.4. GPIR 1.2.2 Release

The Grid Portal Information Repository (GPIR) provides portals and other potential clients with their data persistence needs that are catered to portal users. GPIR provides a mechanism to store static data about a grid – such as machine names, CPUs, machine description – and dynamic data such as queue information, load, status – in a readily accessible database with easy to use web service interfaces. Dynamic data such as job queue information is updated via a GPIR web services ingester and static data such as machine name is updated through an administrative web client. The GPIR 1.2.2 release is available to the public and easy to configure, install and download. It contains the GPIR service and a set of custom providers that can be installed on remote resources to help gather the data required for GPIR. Currently, GPIR 1.2.2 is being used in the TACC User Portal, TeraGrid User Portal, SURA Portal, TIGRE Portal, and other portal that are not in production.

#### 4.4.5. OGCE Web Site Revision

TACC and Indiana team members completed a complete revision of the OGCE website, [www.collab-ogce.org](http://www.collab-ogce.org). The revised site is built with the Maven 1.0.2 XDoc tool. This allows us to easily distribute the task of managing, updating, and controlling revisions to the content of the Web site, which has been checked into the OGCE CVS repository.

### 4.5. Training and Outreach

Activity	Description
GCE Working Group Meeting at GGF 14, June 26-30, 2005.	OGCE members reorganized the GCE working group meeting for GGF 14. Our primary activity was planning the upcoming GCE Workshop at Supercomputing 2005. See <a href="http://www.gridforum.org/ggf_events_ggf14.htm">http://www.gridforum.org/ggf_events_ggf14.htm</a> for additional information.
Science Gateways Meeting at GGF 14, June 26-30, 2005	Several OGCE members participated in the Science Gateways workshop. These included both presentations by M. Pierce on the OGCE project and presentations by OGCE-supported portals such as LEAD and the North Carolina Biportal effort. Additional information is available from <a href="http://www.gridforum.org/GGF14/ggf_events_next_schedule_Gateways.htm">http://www.gridforum.org/GGF14/ggf_events_next_schedule_Gateways.htm</a> .
Science Portals Workshop at GGF 15, October 3-6, 2005	OGCE members M. Pierce, D. Gannon, C. Severance, and J. Futrelle organized the workshop, “New Technologies for Science Portals.” The workshop included 5 presentations and supplemental material. Additional information is available from <a href="http://www.collab-ogce.org/GGF15Workshop/">http://www.collab-ogce.org/GGF15Workshop/</a> .
Richard Tapia	M. Pierce gave a tutorial on portals and portal software in the “Cyberinfrastructure”

Conference, October 19-22 2005	workshop of the 2005 Tapia Conference. For additional information, see “Presentations” below and <a href="http://www.ncsa.uiuc.edu/Conferences/Tapia2005/workshop_abstracts_and_bios.html">http://www.ncsa.uiuc.edu/Conferences/Tapia2005/workshop_abstracts_and_bios.html</a> .
GCE Workshop at Supercomputing November 18, 2005.	OGCE members M. Thomas and M. Pierce helped organized the first GCE Portals Workshop, and several OGCE members assisted as technical committee members. The workshop included five presentations in the plenary session and sixteen poster presentations. The workshop was attended by over 50 participants. Additional information is available from <a href="http://pipeline0.ace1.sdsu.edu/mtgs/gce05/">http://pipeline0.ace1.sdsu.edu/mtgs/gce05/</a> .
I533 Indiana University Seminar on Chemical Informatics	M. Pierce gave a series of three lectures on Grid computing, science portals, and Web Services for IU’s I533 seminar course. Additional information is available from <a href="http://www.indiana.edu/~cheminfo/I533/533home.html">http://www.indiana.edu/~cheminfo/I533/533home.html</a> .
Teragrid 2006	Participation in the Gateways tutorials at the Teragrid 2006 conference, Indianapolis June 2006, as well as the Teragrid Institute Tutorials
SC06 Workshops Chair	Thomas is serving as the Chair for SC06 Workshops. She is in charge of the program committee and organizing the program schedule for SC.

## 4.6. 2005-2006 Publications and Presentations

### 4.6.1. Presentations and Posters

- Charles Severance, Sakai Update, Virtual Research Environments Workshop, June 22, 2005 Manchester, UK.
- M. P. Thomas, J. Burruss, L. Cinquini, G. Fox, D. Gannon, L. Gilbert, G. von Laszewski, K. Jackson, D. Middleton, R. Moore, M. Pierce, B. Plale, A. Rajasekar, R. Regno, E. Roberts, D. Schissel, A. Seth, and W. Schroeder Poster on [Grid Portal Architectures for Scientific Applications](#) for SciDAC 2005 [meeting](#) June 26-30 2005 San Francisco.
- Marcus Christie, LEAD Portal: a TeraGrid Gateway and Application Service Architecture, GGF 14 Science Gateways Workshop, June 28 2005, Westin Michigan Avenue, Chicago, Illinois.
- Marlon Pierce [Grids and Portals for VLAB](#) VLAB Workshop, University of Minnesota July 21-23.
- Marlon Pierce [Portals, Portlets, and Clients to Grid Services](#) IRIS Web Services Workshop, Monterey CA, September 21-23.
- Marlon Pierce [Using AJAX](#) at [GGF 15 Portals Workshop](#), October 3-6 2005, Boston, MA.
- Marlon Pierce [A Portal Architecture Review](#) at [GGF 15 Portals Workshop](#), October 3-6 2005, Boston, MA.
- Marlon Pierce [Integrating Geographical Information Systems and Grid Applications](#) at [GGF 15 GIS Grid Workshop](#), October 3-6 2005, Boston, MA.
- Charles Severance, Using the Sakai Collaborative Toolkit in eScience Applications at GGF 15 Portals Workshop, October 3-6 2005.

- Suresh Marru, Grid Computing for Real World Applications, Oklahoma Supercomputing Symposium 2005, October 5th 2005, University of Oklahoma at Norman.
- Marlon Pierce [Building Web Portals as Science Gateways](#) Richard Tapia Conference, October 19-22 2005, Albuquerque, NM.
- Dennis Gannon, "Predicting Tornadoes with Data Driven Workflows: Building a Service Oriented Grid Architecture for Mesoscale Meteorology Research", co-authored with Beth Plale, Microsoft e-Science workshop, Oct. 2005.
- Jay Alameda, "Web Services Experiences in the Linked Environments for Atmospheric Discovery (LEAD) ITR Project", panel presentation/discussion for panel "State of the Art in Web Services for Ocean Science", OOSTech2005 "Web Services for Interoperable Ocean Science", October 24-26, 2005.
- OGCE Collaboration posters for SC05 November 12-18 2005 Seattle
  - [OGCE Architecture: Portlets and Services for Science Gateways](#)
  - [OGCE Tools Support Collaboration, Data Management, and Application Development](#)
  - [OGCE Portal Applications for Grid Computing I](#)
  - [OGCE Portal Applications for Grid Computing II](#)
- Dennis Gannon, Keynote Presentation, "Lessons Learned While Building Grids: a View of Some Research Challenges" co-authored with Beth Plale. International Grid Workshop 2005, held in conjunction with SC2005, Seattle, Nov. 2005.
- Mehmet Nacar, Mehmet Aktas, Marlon Pierce, Zhenyu Lu, Gordon Erlebacher, Dan Kigelman, Evan F. Bollig, Cesar De Silva, Benny Sowell, and David A. Yuen [VLab: Collaborative Grid Services and Portals to Support Computational Material Science](#) at [GCE'05 Workshop](#) on Grid Computing. Seattle, WA. November 18 2005.
- Jay Alameda, Shawn Hampton, Brian Jewett, Albert Rossi, Bob Wilhelmson. Ensemble Broker Service Oriented Architecture for LEAD at 22<sup>nd</sup> International Conference on Interactive Information Processing Systems for Meteorology, Oceanography, and Hydrology, American Meteorological Society 2006 Annual Meeting, Atlanta, Georgia. January 28-Feb 2, 2006.
- Marlon Pierce [Building Web Portals as Science Gateways](#) at [I533 Seminar](#) in Chemical Informatics: Molecular Informatics, the Data Grid, and an Introduction to eScience [March 2 2006](#). Pierce also gave lectures on Grid computing and Web Services.
- Mehmet Nacar [JSF Custom Grid Tags](#) March 2006 VLAB Meeting, Florida State University.
- Charles Severance, Collaborative eScience: Evolving Approaches, Rutgers Internet2 Day, New Brunswick, NJ - April 4, 2006
- Marcus Christie, TeraGrid Science Gateways Tutorial; Using the LEAD Portal, Accelerating Research with Grid Computing, A Workshop for Researchers at Montana State University & Lariat-West Partner Institutions, April 14, 2006, Montana State University, Bozeman, Montana
- Dennis Gannon, Keynote Presentation, "Opportunities and Challenges for Future Generation Grid Research", the Annual Symposium on Advanced Computing Systems and Infrastructures, Osaka, Japan, May 2006.
- Jay Alameda, Kate Ericson, "TeraGrid Roaming", at TeraGrid Institute Tutorial, TeraGrid 2006, Indianapolis, Indiana, June 12-15, 2006.

- Albert L. Rossi, Shawn Hampton, Emily Wu, Darren Adams, Jay Alameda, “NCSA Trebuchet: A Powerful File Management Interface for TeraGrid”, TeraGrid 2006, Indianapolis, Indiana, June 12-15, 2006.
- Jay Alameda, Greg Daus, Shawn Hampton, Brian Jewett, Scott Parker, Albert Rossi, Bob Wilhelmson, “Brokering Metaworkflows”, TeraGrid 2006, Indianapolis, Indiana, June 12-15, 2006.
- Jay Alameda, “Disaster Planning and Reliable Software”, Technology Presentation at NCSA 2006 Private Sector Program Annual Meeting, June 19-21, 2006.

#### 4.6.2. Books and Book Chapters

- Taylor, E. Deelman, D. Gannon, M. Shields, “Workflows for eScience: Adaptive Workflows for Mesoscale Meteorology”, Springer Verlag. To appear Dec. 2006.
- D. Gannon, B. Plale, S. Marru, G. Kandaswamy, Y. Simmhan, and S. Shirasuna, Dynamic, Adaptive Workflows for Mesoscale Meteorology, To Appear in “Workflows for eScience: Scientific Workflows for Grids”, Chapter 10,
- P. Kumar, J. C. Alameda, P. Bajcsy, M. Folk, M. Markus, “Hydroinformatics: Data Integrative Approaches in Computation, Analysis, and Modeling”, Taylor and Francis, 2006.
- Work Coordination for Grid Computing in to be published, Gregor von Laszewski, Mihael Hategan, and Deepti Kodeboyina, Argonne National Laboratory, Argonne IL, 60430, USA gregor@mcs.anl.gov, 2006. <http://www.mcs.anl.gov/~gregor/papers/vonLaszewski-work-coordination.pdf>.
- Java CoG Kit Workflow in to be published, Gregor von Laszewski, Mihael Hategan, and Deepti Kodeboyina, Argonne National Laboratory, Argonne IL, 60430, USA gregor@mcs.anl.gov, 2006. <http://www.mcs.anl.gov/~gregor/papers/vonLaszewski-workflow-book.pdf>.

#### 4.6.3. Conference Publications (In chronological order)

- M. P. Thomas, J. Burruss, L. Cinquini, G. Fox, D. Gannon, L. Gilbert, G. von Laszewski, K. Jackson, D. Middleton, R. Moore, M. Pierce, B. Plale, A. Rajasekar, R. Regno, E. Roberts, D. Schissel, A. Seth, and W. Schroeder [Grid Portal Architectures for Scientific Applications](#) Proceedings of SciDAC 2005 [meeting](#) June 26-30 2005 San Francisco.
- A Repository Service for Grid Workflow Components. Gregor von Laszewski and Deepti Kodeboyina. In International Conference on Autonomic and Autonomous Systems International Conference on Networking and Services. IEEE, 23-28 October 2005. <http://www.mcs.anl.gov/~gregor/papers/vonLaszewski-workflow-repository.pdf>.
- Mehmet Nacar, Mehmet Aktas, Marlon Pierce, Zhenyu Lu, Gordon Erlebacher, Dan Kigelman, Evan F. Bollig, Cesar De Silva, Benny Sowell, and David A. Yuen [VLab: Collaborative Grid Services and Portals to Support Computational Material Science GCE'05 Workshop](#) on Grid Portals.at SC05 Seattle, WA. November 18 2005.
- Mehmet A. Nacar, Mehmet S. Aktas, Marlon Pierce, Zhenyu Lu and Gordon Erlebacher, Dan Kigelman, Evan F. Bollig, Cesar De Silva, Benny Sowell, and David A. Yuen [VLab: Collaborative Grid Services and Portals to Support Computational Material Science](#) Dec 30, 2005 Special Issue on Grid Portals based on SC05 [GCE'05 Workshop](#), Concurrency and Computation: Practice and Experience.

- Ahmet Fatih Mustacoglu, Wenjun Wu, and Geoffrey Fox [Internet Calendaring and Scheduling Core Object Specification \(iCalendar\) Compatible Collaborative Calendar-Server \(CCS\) Web Services](#) IEEE 2006 International Symposium on Collaborative Technologies and Systems CTS 2006 [conference](#) Las Vegas May 14-17 2006.
- Beth Plale, Dennis Gannon, Daniel A. Reed, Sara J. Graves, Kelvin Droegemeier, Bob Wilhelmson, Mohan Ramamurthy: Towards Dynamically Adaptive Weather Analysis and Forecasting in LEAD. International Conference on Computational Science (2) 2005: 624-631
- Yogesh Simmhan, Beth Plale, Dennis Gannon: A survey of data provenance in e-science. SIGMOD Record 34(3): 31-36 (2005)
- Sangmi Lee Pallickara, Beth Plale, Liang Fang, and Dennis Gannon, "End-to-End Trustworthy Data Access in Data-Oriented Scientific Computing", CCGrid 2006, Singapore, May, 2006.
- Y. L. Simmhan, B. Plale, D. Gannon, and S. Marru, Performance Evaluation of the Karma Provenance Framework for Scientific Workflows, To Appear in Lecture Notes in Computer Science, 2006 & International Provenance and Annotation Workshop (IPAW), 2006.
- Yogesh Simmhan, Beth Plale, Dennis Gannon: Towards a Quality Model for Effective Data Selection in Collaboratories. ICDE Workshops 2006: 72
- Wei Lu, Kenneth Chiu, Aleksander Slominski, and Dennis Gannon, "A Streaming Validation Model for SOAP Digital Signature" The 14th IEEE International Symposium on High Performance Distributed Computing (HPDC-14), 2005.
- Beth Plale, Dennis Gannon, Daniel A. Reed, Sara J. Graves, Kelvin Droegemeier, Bob Wilhelmson, Mohan Ramamurthy, "Towards Dynamically Adaptive Weather Analysis and Forecasting in LEAD". International Conference on Computational Science (2) 2005: 624-631
- L. Fang and D. Gannon, "XPOLA: An Extensible Capability-based Authorization Infrastructure for Grids", 4th Annual PKI R\&D Workshop: Multiple Paths to Trust, NIST Gaithersburg, MD April 19-21, 2005.
- Dennis Gannon, Beth Plale, Marcus Christie, Liang Fang, Yi Huang, Scott Jensen, Gopi Kandaswamy, Suresh Marru, Sangmi Lee Pallickara, Satoshi Shirasuna, Yogesh Simmhan, Aleksander Slominski, Yiming Sun, Service Oriented Architectures for Science Gateways on Grid Systems. ICSOC 2005: 21-32
- Sangmi Lee Pallickara, Beth Plale, Scott Jensen, Yiming Sun, Monitoring Access to Stateful Resources in Grid Environments. IEEE SCC 2005: 343-346
- Gopi Kandaswamy, and Dennis Gannon. A Mechanism for Creating Scientific Application Services On-demand from Workflows. Workshop on Web Services-based Grid Applications, to appear Aug 2006
- Yi Huang, Aleksander Slominski, Chathura Herath, and Dennis Gannon WS-Messenger: A Web Services based Messaging System for Service-Oriented Grid Computing. IEEE International Symposium on Cluster Computing and the Grid, Singapore, to appear May 2006
- Y.L. Simmhan, B. Plale, D. Gannon, & S. Marru, Performance Evaluation of the Karma Provenance Framework for Scientific Workflows. International Provenance and Annotation Workshop (IPAW), 2006

- Y.L. Simmhan, B. Plale & D. Gannon., A Framework for Collecting Provenance in Data-Centric Scientific Workflows. Accepted for the International Conference on Web Services (ICWS), to appear 2006.
- Srinath Perera, Dennis Gannon, Enabling Web Service Extensions for Scientific Workflows, The Workshop on Workflows in Support of Large-Scale Science, to appear Paris June, 2006.
- Wei Lu, Kenneth Chiu, and Dennis Gannon. Building a generic soap framework over binary xml. In The 15th IEEE International Symposium on High Performance Distributed Computing (HPDC-15), to appear June 2006.
- Eric Roberts, Jay Boisseau, Maytal Dahan, TeraGrid User Portal: An Integrated Interface for TeraGrid User Information & Services, Accepted for the TeraGrid Conference 2006.
- Hao Yin, Donald F. McMullen, Mehmet A. Nacar, Marlon Pierce<sup>1</sup>, Kianosh Huffman, Geoffrey Fox<sup>1</sup>, Yu Ma, "Providing Portlet-Based Client Access to CIMA-Enabled Crystallographic Instruments, Sensors, and Data." Submitted to GRID 2006.

#### 4.6.4. Journal Publications and Technical Reports

- Dennis Gannon and Geoffrey Fox [Workflow in Grid Systems](#) Editorial of special issue of Concurrency&Computation: Practice&Experience based on GGF10 Berlin [meeting](#).
- Beth Plale, Jay Alameda, Bob Wilhelmson, Dennis Gannon, Shawn Hampton, Al Rossi, Kelvin Droegemeier: Active Management of Scientific Data. IEEE Internet Computing 9(1): 27-34 (2005)
- K. Droegemeier, D. Gannon, D. Reed, B. Plale, J. Alameda, T. Baltzer, K. Brewster, R. Clark, B. Domenico, S. Graves, E. Joseph, D. Murray, R. Ramachandran, M. Ramamurthy, L. Ramakrishnan, J. Rushing, D. Webeer, R. Wilhelmson, A. Wilson, M. Xue, S. Yalda, "Service-Oriented Environments for Dynamically Interacting with Mesoscale Weather", CiSE, Computing in Science & Engineering -- November 2005, vol. 7, no. 6, pp. 12-29.
- Beth Plale, Dennis Gannon, Yi Huang, Gopi Kandaswamy, Sangmi Lee Pallickara, and Aleksander Slominski, "Cooperating Services for Data-Driven Computational Experimentation", CiSE, Computing in Science & Engineering -- September 2005, vol. 7 issue 5, pp. 34-43
- Gopi Kandaswamy, Dennis Gannon, Liang Fang, Yi Huang, Satoshi Shirasuna, Suresh Marru, "Building Web Services for Scientific Applications", IBM Journal of Research and Development, Vol 50, No. 2/3 March/May 2006.
- Jay Alameda, Marcus Christie, Geoffrey Fox, Joe Futrelle, Dennis Gannon, Mihael Hategan, Gregor von Laszewski, Mehmet A. Nacar, Marlon Pierce, Eric Roberts, Charles Severance, and Mary Thomas [The Open Grid Computing Environments Collaboration: Portlets and Services for Science Gateways](#) Accepted for publication in Concurrency and Computation: Practice and Experience Special Issue for Science Gateways GGF14 [workshop](#).
- Java CoG Kit Workflow Concepts, Gregor von Laszewski and Mihael Hategan, in Journal of Grid Computing, <http://www.mcs.anl.gov/~gregor/papers/vonLaszewski-workflow-jgc.pdf>. Electronic Publication Link, Jan. 2006. <http://dx.doi.org/10.1007/s10723-005-9013-5>

- The Grid-Idea and Its Evolution, Gregor von Laszewski, accepted for publication in the Journal of Information Technology, <http://www.mcs.anl.gov/~gregor/papers/vonLaszewski-grid-idea.pdf>.

## 5. Year 4 (2006-2007) Project Summary and Highlights

The OGCE project has consistently met its deliverables and has also established numerous direct collaborations with portal application developers. Year 4 was a no-cost extension effort aimed at wrapping up existing projects and releases. The project participants also redirected its focus to the TeraGrid Gateway projects and as a result, successfully won an OCI SDCI three-year project funded to support portals and web services for a select group of TeraGrid Gateways.

### 5.1. Collaborations and Support for Portal Developers

We continued our earlier outreach program to directly assist portal development groups listed below.

Activity	Description
CIMA Portal	We assisted the CIMA team as they add Globus-based job submission, monitoring, and file management services.
VLAB Portal	We provide core Grid portal development support for VLAB, which manages computational chemistry and material science workflows.
CICC Portal	We developed portals and services for this NIH-funded project for combining databases and data mining applications.
LEAD Portal	OGCE software is used in this portal for meteorology researchers and students. Beta test release as part of Teragrid Gateways project in august 2006.
RENCI Bioportal	A portal for life sciences was built using OGCE technology by the Renaissance Computing Institute
TeraGrid User Portal	OGCE software helps power this portal that provides account management, resource monitoring, and documentation services for TeraGrid users.
GGF-GIN-DATA	Integration of a testing framework for GridFTP
ReDRess	Continue support of ReDRess portal team at Lancaster University (UMICH).
National Grid Service (NGS) Portal	Work with the Daresbury team developing their portal (UMICH).
TIGRE User Portal	A portal that is a gateway to TIGRE grid users and provides resource monitoring, user documentation, and consulting
TeraGrid Open Life Sciences Gateway (OLSG)	The OLSG seeks to develop BioGrid services based on the TeraGrid and NMI tools, deploy them on multiple infrastructures, and put them into production with a well-defined user community.

### 5.2. Activities and Findings

The OGCE collaboration relies on the adoption of the JSR 168 standard for portlets as one of its foundations. This standard is currently undergoing significant revision, and we expect the

follow-on JSR 286 standard and reference implementation to be available in the near future. We therefore funded Sakai integration with Apache Pluto 1.1, the JSR 168 reference implementation. Pluto developers will also lead the JSR 286 reference implementation, so the Sakai container will provide a foundation for future supporting evolving standards.

### **5.2.1. University of Michigan Deliverables: Sakai JSR 168 Support**

**JSR 168 Support:** Earlier OGCE releases integrated Sakai capabilities as JSR 168 portlets using Web service calls from an OGCE portal to a co-installed Sakai portal. During the extension period we reversed this process by adding Apache Pluto 1.1's portlet engine into Sakai. This allows Sakai to directly support JSR 168 portlets, including the OGCE's Grid portlet suite. We are currently in the process of automating this as an installation

**Other Deliverables:** We add Sakai to the NMI build/test facilities at University of Wisconsin. We also used this as a template for integrating OGCE's revised build system into the NMI testbed.

### **5.2.2. San Diego State University Deliverables**

**SRB Portlets:** Completion of SRB portlets using AJAX and most current release of SRB. Portlets were demonstrated to work using GSI (MyProxy Portlet) or SRB authentication. Portlets demonstrated to work on TeraGrid, DOE Grid, as well as local test grids.

**OLSG Portal:** preliminary investigations into the the architecture and desing of an OGCE based OLSG portal were initiated. A PhD student began development of a simple prototype portal, which will be part of her research.

**GCOM Portal:** SDSU is developing a community portal based on the General Coastal Ocean Model framework, which will allow clients to run and archive simulations to model coastal water systems in the San Diego Coastal region.

**Courses:** Thomas taught a graduate level course in grid computing at SDSU based on developing python tools such as mathematical services that run on the TeraGrid and used TG security services as well. The NMI pyWSRF and pyGlobus tools were extensively used. The class worked with developers at LBL to debug various aspects of the tools.

**Completed investigations into use of Python CMS frameworks** as candidates for grid portals. Frameworks tested included Zope, Django, and others. Conclusion: content management systems are complex, with data base systems not easily modified/alterd and thus not useful for programming environments needed to develop useful HPC grid portals.

**Python Tools:** Investigated the use of Python based WSRF services and integration with OGCE portlets. The use of the NMI PyWSRF toolkit proved to be flexible and easy to use, with easy integration behind both python and java based portlets.

### 5.2.3. NCSA Deliverables

**Tupelo 2:** Tupelo 2.0 was released in July 2007 as part of the no-cost extension, and is available on the Tupelo website ([http://dlt.ncsa.uiuc.edu/wiki/index.php/Tupelo\\_2](http://dlt.ncsa.uiuc.edu/wiki/index.php/Tupelo_2)). It has subsequently been used in both the Palantir distributed incident response system (<http://www.ncassr.org/features/index.php?id=17>) and the CyberIntegrator desktop workflow environment ([http://gsa.confex.com/gsa/2007GE/finalprogram/abstract\\_122297.htm](http://gsa.confex.com/gsa/2007GE/finalprogram/abstract_122297.htm)). Active development continues with a 2.1 release due Q1 2008.

**Ensemble Broker Related Deliverables:** We completed a first release of the broker and related interfaces, as well as the user interface, which is fully documented at <http://torcida.ncsa.uiuc.edu:8080/confluence/display/MRDPUB/MRD+Public+Space+Home+Page>. We also integrated the broker with MyLEAD (see the MyLEAD Relay Agent at <http://torcida.ncsa.uiuc.edu:8080/confluence/display/MRDPUB/MyLEAD+Relay+Agent>) but were not able to complete a Tupelo integration in the timeframe of the no-cost extension, partly as tupelo 2 was built at a lower level than a full metadata catalog. This broker was used to manage over 1000 automatically triggered severe storm simulations as part of LEAD's involvement in the NOAA Spring Hazardous Weather Experiment (see results at <http://rt.atmos.uiuc.edu/trigger/>), and is currently being used in atmospheric science research by some of our research collaborators. One significant change we made for scalability of job submission and management was to provide for the ability to use GSI-SSH for submission and monitoring, rather than pre-WS GRAM. This has proven to be a reliable and scalable job submission and monitoring mechanism for the cases we have tried (submitting 40-100 concurrent jobs), which would be difficult to impossible to do with GRAM. .

### 5.2.4. Indiana University Deliverables

**Condor and Condor-G Portlets:** Updates to the Condor Web Service interface ("Birdbath") in Condor's 6.8 production series were incompatible clients based on the 6.7 research and development series. We thus rewrote the OGCE Condor portlet from scratch using Java Server Faces. We also extended this to provide support for Condor-G. This acts as a universal Grid client.

**Project Code Organization Revisions:** We made two significant technical updates to our code's build system and source code version control. First, the current OGCE release's build system is based on Apache Maven 1.0.2 with some supplemental UNIX Bash shell scripts. Maven 1.0 has been superseded by Maven 2, which provides potentially powerful distributed build tools that would benefit our project (see <http://communitygrids.blogspot.com> for our exploratory notes). We reorganized the build system entirely to make use of Maven 2, completely eliminating dependence on Maven 1 and shell scripting. This makes the installation process independent of UNIX-like operating systems. The reorganization had the added benefits of a) vastly simplifying the process for recompiling and redeploying individual portal components, and b) allowing us to extend the system with third party components such as alternative JSR 168 containers. For more details, see the OGCE web site and the OGCE announcement blog, <http://collab-ogce.blogspot.com>.

Second, OGCE source code was migrated from the CVS repository at Argonne National Laboratory to SVN at SourceForge. The OGCE SourceForge page is

<http://sourceforge.net/projects/ogce>, and the SVN repository can be viewed at <http://ogce.svn.sourceforge.net/viewvc/ogce/>. SVN has many improvements over its CVS ancestor, including its ability to hook together multiple, semi-independent repositories. This should greatly simplify our integration with projects such as GridSphere and Sakai.

### 5.2.5. Science Portal Community Leadership: GCE Workshops

We continued the very successful Grid Computing Environments 2005 workshop with the even larger GCE 2006, held in Tampa in conjunction with Supercomputing 2006. The workshop consisted of peer-reviewed papers from an international group of authors over two days. More information is available from the GCE 06 Web Site: <http://wiki.cogkit.org/index.php/GCE06>.

GCE 07 was also planned during the extension period. We followed the same format at GCE 06, with two days of peer-reviewed papers. More information on the workshop is available from <http://www.collab-ogce.org/gce07>. Finally, the proceedings for GCE05 were published in *Concurrency and Computation: Practice and Experience*, Volume 19, Issue 12. For the table of contents, see <http://www3.interscience.wiley.com/journal/114298946/issue>.

## 5.3. Products, Software, and Web Sites

**Products and Software:** Software development work is summarized in Section 5.2. During the extension period, we had two OGCE core portal releases.

- Version 2.0.4 (November, 2006) was configured to work using TeraGrid resources (including TeraGrid GridFTP, GRAM, and GPIR services). The PURSe portlets were also added to the main build.
- Version 2.1 (June 2007): This version included major revisions to the Condor portlet and added support for Condor-G.

In addition to the OGCE portal releases, the Sakai 2.4 release (see Section 5.2.1) integrates the Pluto 1.1 implementation of JSR 168 portlets, allowing us to embed OGCE grid portlets into the Sakai container. This process requires manual installation of the OGCE portlets, but work to automate this into build process is nearing completion.

**Web Site:** The OGCE web site is <http://www.collab-ogce.org>. This site is built with XDoc and compiled using Maven. The entire site is managed using our SVN repository and is downloadable for users who need offline documentation. We have subsequently replaced this site with a MediaWiki-based web site that simplifies content management.

## 5.4. Training and Outreach

OGCE team members give frequent presentations and lectures, which we list in Section 5.5.1. In addition, we organized the second and third Grid Computing Environments workshops (see Section 5.2.5). SDSU (Thomas) taught a graduate level course in advanced grid computing infrastructure. Course was based on developing pyWSRF-based mathematical services that run on the TeraGrid, behind the OGCE portal, and used TG security services as well.

## 5.5. Publications

### 5.5.1. Presentations and Posters

- Dennis Gannon, Keynote Speaker, "Challenges for Grid Computing: Connecting Users to Each Other and to Applications and Data" CoreGrid Symposium, with EuroPar 2007, Rennes, France, Aug. 2007.
- Dennis Gannon, Panel Presentation, "CyberInfrastructure to Support Scientific Exploration and Collaboration", Microsoft Faculty Summit, Redmond, WA. July 2007.
- Mehmet A. Nacar, Jong Youl Choi, Marlon Pierce, Geoffrey Fox, "Building Grid Portals with OGCE: Big Red Portal and GTLAB" Presentation at TeraGrid 2007 Conference Madison Wisconsin June 5 2007.
- Marlon Pierce, "OGCE Short Summary," Software Provider Forum at TeraGrid 2007 Conference Madison Wisconsin June 5 2007.
- Dennis Gannon, "An Introduction to Gateway Programming", TeraGrid Conference 2007, Madison, Wisconsin. June, 2007
- Dennis Gannon, Keynote Speaker, "Programming Gateways to the TeraGrid", Workshop on Grid programming model, Grid and P2P systems architecture and Grid systems, tools and environments, Crete, Greece, June 2007.
- Marlon Pierce and Jim Myers Gateways and Cyberenvironments and Web 2.0 Birds of a Feather at TeraGrid 2007 Conference Madison Wisconsin June 5 2007.
- Geoffrey Fox and Marlon Pierce, "Web 2.0 in a Web Services and Grid Context Part I: CTS2007 Web 2.0 Tutorial," Part I of Tutorial at 2007 International Symposium on Collaborative Technologies and Systems (CTS 2007) May 21 2007.
- Marlon Pierce and Geoffrey Fox, "Web 2.0 Tutorial: Part 2," Part II of Tutorial at 2007 International Symposium on Collaborative Technologies and Systems (CTS 2007) May 21 2007.
- Marlon Pierce, "Web Service Foundations: WSDL and SOAP," I590 Class IUPUI April 5 2007.
- Marlon Pierce, "Open Grid Computing Environments" at OGF19 Software Developers Track, Friday Center Chapel Hill NC January 29 2007.
- Jay Alameda, Robert Wilhelmson, Albert Rossi, Shawn Hampton, Brian Jewett, Thomas Baltzer, Anne Wilson. Siege: A Graphical User Interface to Enable Management of Large Numbers of Weather Simulations, Presentation at 23<sup>rd</sup> International Conference on Interactive Information Processing Systems for Meteorology, Oceanography, and Hydrology, American Meteorological Society 2007 Annual Meeting, San Antonio, Texas. January 18, 2007, Talk 8B.3.
- Marlon Pierce, Jong Youl Choi OGCE Portal Software for Big Red and the TeraGrid Booth Presentation at SC06 Tampa Florida, November 12-17 2006.
- Mehmet Nacar, Marlon Pierce, Gordon Erlebacher, Geoffrey Fox, "Designing Grid Tag Libraries and Grid Beans." Second International Workshop on Grid Computing Environments GCE06 at SC06, Tampa, FL. Nov. 12-13 2006.
- Hao Yin, Sofia Brenes-Barahona, Donald F. McMullen, Marlon Pierce, Kianosh Huffman, Geoffrey Fox, "A PERMIS-based Authorization Solution between Portlets and Back-end Web Services." Second International Workshop on Grid Computing Environments GCE06 at SC06, Tampa, FL. Nov. 12-13 2006.

- Jay Alameda, “Grid Brokering and Improved Quality of Service (“on-demand”) for Computational Science”, Geosciences Scientific Workflow and On Demand Computing Workshop, Los Angeles, CA, October 25, 2006.
- Marlon Pierce, Dennis Gannon Charles Severance, Gregor von Laszewski, Mary Thomas, and Eric Roberts, “OGCE Briefing to NSF OCI”, August 22 2006
- Mary Thomas, José Castillo, Germán Larrazábal, Carlos Torres The General Curvilinear Ocean Model (GCOM) Cyberinfrastructure Environment, Presented at the annual SDSU CSRC HPC Symposium, April, 2007.
- Mary Thomas. SDSU Computational Sciences and Cyberinfrastructure Research Grid (CSCRGrid). Presented to SDSU Management (Deans, Provost, VP of Research, etc.), and at the kickoff meeting for the SDSU Research Grid Project, 2007.

### 5.5.2. Book Chapters

- Geoffrey C. Fox, Rajarshi Guha, Donald F. McMullen, Ahmet Fatih Mustacoglu, Marlon E. Pierce, Ahmet E. Topcu, and David J. Wild, “Web 2.0 for Grids and e-Science,” INGRID 2007 - Instrumenting the Grid 2nd International Workshop on Distributed Cooperative Laboratories - S.Margherita Ligure Portofino, ITALY, April 18 2007.
- Marlon E. Pierce, Geoffrey Fox, Huapeng Yuan, and Yu Deng, “Cyberinfrastructure and Web 2.0”, Proceedings of HPC2006 July 4 2006 Cetraro Italy.
- Alameda, J., Rossi, A. L. , Hampton, S., 2007, in IFIP International Federation for Information Processing, Volume 239, Grid-Based Problem Solving Environments; eds. P.W. Gaffney, Pool, J.C.T.; (Boston: Springer), pp. 339-348.
- 

### 5.5.3. Conference Publications

- Mehmet A. Nacar, Marlon E. Pierce, Geoffrey C. Fox GTLAB: Grid Tag Libraries Supporting Workflows within Science Gateways 3rd International Conference on Semantics, Knowledge and Grid SKG2007 Xian China October 28-30 2007.
- Mehmet A. Nacar, Jong Y. Choi, Marlon E. Pierce, and Geoffrey C. Fox, “Building a Grid Portal for Teragrid’s Big Red,” Proceedings of TeraGrid 2007 Conference Madison Wisconsin June 4-8 2007.
- Mehmet Nacar, Marlon Pierce, Gordon Erlebacher, Geoffrey Fox. Designing Grid Tag Libraries and Grid Beans Second International Workshop on Grid Computing Environments GCE06 at SC06, Tampa, FL. Nov. 12-13 2006.
- Hao Yin, Sofia Brenes-Barahona, Donald F. McMullen, Marlon Pierce, Kianosh Huffman, Geoffrey Fox, A PERMIS-based Authorization Solution between Portlets and Back-end Web Services. Second International Workshop on Grid Computing Environments GCE06 at SC06, Tampa, FL. Nov. 12-13 2006.
- J. Y. Choi, Y. Yang, S. Kim, and D. Gannon, V-Lab-Protein: Virtual Collaborative Lab for Protein Sequence Analysis, Proceedings of the IEEE Workshop on High-Throughput Data Analysis for Proteomics and Genomics, Fremont, CA Nov. 2007.
- M. Thomas, J. Castillo, C. Torres, M. Stemska. Development of Cyberinfrastructure for the Southern California Coastal Ocean Model. In preparation for submission to HPDC or SC08.

#### **5.5.4. Journal Publications and Technical Reports**

- Mehmet A. Nacar, Mehmet S. Aktas, Marlon E. Pierce, Zhenyu Lu, Gordon Erlebacher, Dan Kigelman, Evan F. Bollig, Cesar R. S. da Silva, Benny Sowell, David A. Yuen: VLab: collaborative Grid services and portals to support computational material science. *Concurrency and Computation: Practice and Experience* 19(12): 1717-1728 (2007).
- Jay Alameda, Marcus Christie, Geoffrey Fox, Joe Futrelle, Dennis Gannon, Mihael Hategan, Gopi Kandaswamy, Gregor von Laszewski, Mehmet A. Nacar, Marlon E. Pierce, Eric Roberts, Charles Severance, Mary Thomas: The Open Grid Computing Environments collaboration: portlets and services for science gateways. *Concurrency and Computation: Practice and Experience* 19(6): 921-942 (2007).
- Hao Yin, Donald F. McMullen, Mehmet A. Nacar, Marlon E. Pierce, Kianosh Huffman, Geoffrey Fox, Yu Ma: Providing Portlet-Based Client Access to CIMA-Enabled Crystallographic Instruments, Sensors, and Data. *GRID 2006*: 317-318.
- M. Thomas. GCE 2005: Workshop on Grid Computing Portals. Editorial, *Concurrency and Computation: Practice and Experience*, Volume 19 Issue 12 , Pages 1563 - 1748 (25 August 2007).
- M. Thomas. Investigations into the Parallelization of the General Curvilinear Ocean Model (GCOM) and its Operation Across Cyberinfrastructure Environments. Internal report, SDSU Computational Sciences Research Center. January, 2007.