

FutureGrid

Quarterly Report – Q3 2010 – 1 April to 30 June 2010

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Introduction

This quarterly report provides a summarization of the following bi-weekly reports submitted to NSF each Monday:

April 12, 2010

April 26, 2010

May 10, 2010

May 24, 2010

June 7, 2010

June 21, 2010

The organization of this report follows our biweekly reports:

1. Science Highlights
2. Systems Administration and Network Management Committee
3. Software Committee
4. User Requirements Committee and User Advisory Board
5. Performance Analysis Committee
6. Training, Education, and Outreach Committee
7. User Support Committee
8. Operations and Change Management Committee

Science Outcomes

Sky Computing on FutureGrid and Grid'5000

"Sky computing" is an emerging computing model where resources from multiple cloud providers are leveraged to create large scale distributed infrastructures. This demonstration will show how sky computing resources can be used as a platform for the execution of a bioinformatics application (BLAST). The application will be dynamically scaled out with new resources as need arises. This demonstration will also show how resources across two experimental projects: the FutureGrid experimental testbed in the United States and the Grid'5000, an infrastructure for large scale parallel and distributed computing research in France, can be combined and used to support large scale, distributed experiments. The demo will showcase not only the capabilities of the experimental platforms, but also their emerging collaboration. Finally, the demo will showcase several open source technologies. Specifically, our demo will use Nimbus for cloud management, offering virtual machine provisioning and contextualization services, ViNe to enable all-to-all communication among multiple clouds, and Hadoop for parallel fault-tolerant execution of BLAST.

The UF team has successfully demonstrated ViNe and CloudBLAST (both developed by the UF team) at the 10th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing (CCGrid 2010 – during the 3rd IEEE International Scalable Computing Challenge), and at the Open Grid Forum 29 (OGF29). OGF demonstration marks the collaboration between FG and the Grid'5000 (France) efforts. ViNe was a key component to enable the communication among resources, especially for the heavily protected Grid'5000 resources.

- 150-node virtual cluster across 5 sites, connected through ViNe (including 2 FG sites UF and SDSC) and running CloudBLAST, demonstrated a large scale BLAST run in less than 1 hour (the same job takes over 17 days sequentially)
- OGF29: 457-node virtual cluster across 3 FG sites (UF, UC, SDSC) and 2 G5k sites (Rennes, Sophia) demonstrated the dynamic extension of a Hadoop cluster. A modified Nimbus, with faster VM deployment, was deployed on G5k. As new VMs became available on G5k, the Hadoop worker pool was increased speeding up the CloudBLAST throughput.

Systems Administration & Network Management Committee

Compute and Storage Systems

IU Cray XT5m (“xray”)

- Request for dynamic library support, Cray working with IU to determine if the current storage IO nodes can support a shared root DVS file system to enable Dynamic or Shared Libraries

IU iDataPlex (“india”)

- Stability test completed successfully on April 6th. 735 jobs were run, 12 failed (completion rate of 98.39% with 100% uptime). Intel MPI, specifically the mpd library, was patched by IBM/Intel to correct a bug discovered during testing.
- PAPI testing completed
- FutureGrid software environment beginning installed and configured
- Eucalyptus and a standard HPC available to early users. 33 Eucalyptus nodes configured for use by a FutureGrid early user

UC iDataPlex (“hotel”)

- 14-day stability test completed on 6/5 with 99.6% job completion and 99.925% uptime
- All benchmarking targets met (06/14). Acceptance report sent for approval.

UF iDataPlex (“foxtrot”)

- System passed a 6-day stability test with 100% job completion and 100% uptime
- System released to admins for early user configuration. All 32 nodes will be configured for Nimbus
- System was successfully used for CCGrid demo at UF

SDSC iDataPlex (“sierra”)

- 4-day stability test at SDSC passed with 100% uptime and only 1 failed job
- Nimbus installed and successfully used for CCGrid demo at UF
- 33 nodes of MS HPC Server 2008 provisioned to support an early FG user
- IU administrators configuring dynamic provisioning on the system

TACC Dell (“alamo”)

- Hardware delivered
- System power fully installed
- Installation of compute nodes has begun
- The Linux operating system that will be used for acceptance testing has been loaded on the login node, administrative node, and all of the compute nodes.
- The software to be used in the acceptance tests is being built.

UCSD DDN Storage

During Q3, UCSD worked to connect our two Sun x4540 storage boxes to our Sierra cluster via Infiniband. We installed the Infiniband cards but ran into installation problems and had to revert to the last patch release of Solaris in order to get the cards recognized. We then got IPoIB working and began to test the network connection to the cluster. Unfortunately, we ran into periodic and repetitive problems with the Infiniband cards where the storage machines would not be reachable and the network had to be restarted or the machine rebooted to reinstate the connection. We filed tickets with Sun/Oracle and after a month of support, they informed us that there may be an incompatibility between the Solaris Infiniband drivers and OpenSM (installed on Sierra) and are working with us to resolve it. Also a bad disk was found on one of the storage boxes and was replaced. Despite Infiniband problems, UCSD continued work to configure the storage for Sierra. We setup up four main storage spaces: home, applications, image repository, and scratch. All areas except scratch are configured to take nightly snapshots on the other storage node (e.g., the primary home space will be hosted on nas-0-0 and its backup on nas-0-1). We then developed scripts to setup or cleanup a user's home directory and scratch space along with the snapshot configuration. Similar scripts were written for shared project spaces as well.

Networks

- Backbone connectivity for UF is in production as of 4/20
- The Network status & calendar pages are live from the GlobalNOC
 - http://atlas.grnoc.iu.edu/atlas.cgi?map_name=FutureGrid
 - <http://noc.futuregrid.org/futuregrid/support/operations-calendar3.html>
- The cross connect from CENIC to NLR has completed
- UCSD's SDSC Networking group increased the amount of IP space for FutureGrid use in order to use for the Eucalyptus and Nimbus installs on Sierra. They also continue to work on completing the 10G CENIC connection to FutureGrid and to resolve a router problem with recognizing new machines on the network, inhibiting the Nimbus and Eucalyptus installs on the Sierra cluster

Software Committee

Administration: Greg Pike, was hired at Indiana University to strengthen the systems group. The speed of the developer wiki was significantly increased. There is a plan to update to the hardware on which the wiki is running. An SSL wildcard cert for futuregrid.org has been purchased, which will be installed net quarter.

Documents: Through the software committee we have made a number of documents available that are continuously worked on. The documents include:

- SW-001 approved Template: Formal Software Architecture Document
- SW-002 approved Template: Formal Use Case Format for Extensive Use Case Documents
- SW-018 submitted Template: Manual Page Best Practice

In addition, the following design document describing Phase I software activities

- SW-007 approved Architecture FutureGrid Phase I Software Architecture

All documents are available to developers on the internal wiki

The following documents are being prepared and under development:

- The software architecture for Phase II for dynamic provisioning
- The software architecture for Phase II for security
- The software architecture for Phase II for image management
- The software architecture for Phase II for the portal
- The software architecture for Phase II for the experiment harness
- An update of the software architecture for the Image Repository for the next spiral.

We have conducted a documentation effort and a quality control of the production system, with particular emphasis on the user manual. The goal is to assure the users have a uniform experience on all machines and that all available services are documented. The current user manual is maintained in the wiki. Once the information passes the quality assurance process, it may be handed over to the KB team. We have made it clear to all groups that the development of a minimal user manual has a high priority.

Software Subsystems

Performance: Activities to improve the performance monitoring software have continued. Noteworthy are the discussions of providing web space and support for user's to publish their performance results (FG v TG v Azure v Amazon). The HPCC performance tests are now available through Inca, this has also been shared with the external collaborators at University of Buffalo (see below). Installation of performance tools on test machine is complete. Next step is to provide packages to hardware group for installation on FG machines (the IU applications group and Hardware group is currently designing the process).

Image Repository: We have set up a testing deployment for the image repository. We have also investigated and designed a bunch of distributed data storage models for the images that are suitable for the FG network layout.

Image Creation: A FG image creation and validation system is under design and development. This system will let users pick their desired operating system, a set of preinstalled software specific to their development environment, and the amount of system resources they would like each virtual machine to acquire. A command line interface is targeted however the ultimate goal would be to incorporate such functionality within a portal.

Moab: The original setup of the queuing system used till now had some limitations. Thus, we set up a testbed as part of the software development activities to highlight dynamic provisioning controlled directly from Moab. This is a continuation of the work that we earlier did with a TORQUE/xcat based install. We believe the way this install is conducted will be a key issue towards dynamic provisioning of images via the Moab MSM on FG resources. Interestingly, it was reported that setting up a similar dynamic provisioning via TORQUE and XCAT instead of Moab and XCAT was easier to complete. However, we will be using Moab/XCAT for the general install on the resources, and use TORQUE/XCAT in cases we need to instantiate a virtual cluster within the staged images. A good example for a use case for this is the development of virtual Grid and cluster environments for the software development of FG. As another result we identified that the TORQUE/XCAT solution could be used as a “FG-light” software stack for those that may want to use the most important FG software contributions but do not have the financial means of purchasing an advanced queuing system such as Moab. We have not experimented with replacing Moab with Maui at this time.

The software team identified a bug in the existing Moab distribution (v 5.3.7). A newer build was returned to the software group. The recommendation is to either upgrade to 5.4 or to use a newer build from v5.3.7. Furthermore, we identified that a change in licensing

took place between 5.3.x and 5.4. Versions 5.4 need explicit licensing for dynamic provisioning and on demand power management.

The suggested changes by the software team to the Moab configuration files to support dynamic provisioning have been implemented and are available on sierra. While conducting a performance experiment it was identified that the current Moab configuration prevents us from getting accurate performance data for dynamic provisioning. We are investigating a solution. To support one of our other use cases we are in the need to be able to stage multi-image jobs, e.g. a job that contains multiple different images. This seems not yet to be supported by Moab. We have devised a simple preliminary solution, but will contact the vendor for further input.

Monitoring: For Inca, work has been done between to plan out the Inca interfaces for the portal and improve documentation. Also, the Inca graphing interfaces to display HPCC performance data are being setup. The group also discussed the setup of Netlogger (deployment milestone begins this month) in order to collect performance and load data from FutureGrid components. We pushed back HPCC performance test milestones to the end of July so we can include Tango from TACC.

Experiment Harness: We have evaluated the Qpid message broker to learn more about some advanced features, verify that it meets our needs, and plan how to use it in the Experiment Harness. In particular, we are investigating the dynamic creation of message queues, dynamic modification of who has access to message queues, message filtering, and X.509 authentication. The purpose of this is to be able to authenticate users to the harness and segregate experiment monitoring and management messages so that different user groups do not interfere with each other. We have also spent some time enhancing our experiment harness client and daemon implementations.

Dynamic Provisioning: The software group has obtained their own 60-day test license for Moab. A simple dynamic provisioning experiment has proven successful on the IU testbed (fg-gravel). This test includes provisioning virtual machines via xCAT using Torque to VirtualBox nodes. A minimal CentOS based stack is being designed and integrated into BCFG2 for maintenance and validation. Currently, stateless images are being deployed directly via a ramdisk. Testing and benchmarking is needed to determine the validity of such an environment in a production system. We set up two more machines to support our software activities in order to experiment with dynamic provisioning software solutions. As part of this we now have a first system installed to try out different configurations. This system is completely separate from the FG hardware to ensure it does not effect the operations and acceptance testing of the systems. To create images automatically via a configuration management system, we have installed and deployed a bcfg2 system. However, as we are using Redhat a license is required to get access to the images stored on a repository hosted at IU. Unfortunately, the expert on this is on leave of absence till May 17th, thereby stalling this effort. The software team has

therefore is discussing if a switch to CentOS in general is the better way to go. This has also been done at SDSC unrelated to the FG project. We will have to explore the disadvantages of using CentOS. During discussion with FG systems administrators, the current status indicates that there is no significant impact and that the switch should be ok.

Image Repository: More coding and testing on the Image Repository development has been conducted. A unix man page style documentation has been started and a deployment of the preliminary version at the fg-gravel cluster is conducted. Now the application framework, CLI parsing, back end data persistence are done; and metadata put and query are functioning. Need some more time to complete the image file storage procedure as well as deal with the back end data file deployment issue in the planned *SSH* based approach for the current phase. The Phase II image repository design document has been initiated.

Portal: Work continues on the revision of the futuregrid.org site which will be an intermediate step on the way to the FutureGrid Portal. See the User Support Committee for current Q3 details. The planning document, proposed wireframe and sitemap have been created. Subpages are being built for the two key audiences -- , current and prospective researchers -- and the account and project requests forms will be revised to include additional communication material to manage expectations and describe the process. Additional upcoming tasks include the creation of a feedback form, implementation of the OG Forum module in Drupal, preparation of RSS feeds for news and announcements, and a system notices system.

Two new Google gadgets have been developed. The FutureGrid Hardware/Software List was created to display content about software/hardware availability in FutureGrid. This information will be displayed in appropriate places in the revision of the FutureGrid website that is currently slated for next month. The FutureGrid Core Services was created to display the status of internal services like JIRA, LDAP, WIKI, and INCA.

Security: A significant discussion took place about the proper security implementation for using Certificates on FutureGrid. This included discussion of running our own SimpleCA, using TeraGrid and/or DOE certs, and other various solutions. After this discussion, IU decided to continue to run a SimpleCA as with the Nimbus development environment until October, 2010. Afterwards, a more comprehensive solution will be put in place with a TAGPMA-compliant site, such as SDSC or TACC. We restarted the discussion about a role based authorization and single sign on onto all FG services that was originally envisioned to be part of the Phase I software architecture. Everyone in the Software Committee has been asked to contribute requirements to the security architecture. Various meetings were held to solidify the account creation workflow together with the support group.

Pegasus: A task to run a *very simple* job on all three sites (Xray, India, Sierra) was initiated and completed. The task assures the quality of the installed services and available documentation at their lowest level. An additional issue needs to be addressed to provide a user CA for Nimbus. We worked on updating the Netlogger installation on inca.futuregrid.org to update yet the newest release. The Netlogger broker is integrated into inca.futuregrid.org and comes with `init.d` scripts, and the API libraries for Python, Perl and Java were re-installed. MongoDB was installed. We started the activity to document and discuss a “FG Pegasus Software Stack” and added instruction on how to install Pegasus using a yum repository. To fulfill the requirements of FG new features will be added with the upcoming Pegasus 3.0 release. We have identified that special attention will be placed on dependencies with Globus and Condor.

USC provided preliminary documentation on the installation of Pegasus-WMS on FutureGrid VM images.

Eucalyptus: The long stalled activity of deploying Eucalyptus on india.futuregrid.org was restarted as the person responsible was on family leave and the system administrative group had no additional resources to work on it till now. Networking issues on sierra are still being worked on. The system was available at the end of June.

Nimbus: Several software updates have been conducted to Nimbus resulting in several releases. UC completed integration and testing for Nimbus 2.5 and released Nimbus cloud client version 15 (which includes the FutureGrid root CA certificates, simplifying the client setup for FutureGrid). Nimbus was also installed on the SDSC and UF clusters

Genesis 2: Installation of Genesis 2 on the IU Cray machine was started.

Networking: The software group has communicated to the system administrative group that a move towards IPv6 at this time is unwise as non of our software partners has tested their software with IPv6. A meeting with several people from GNOC took place that demonstrated tools that are only accessible by GNOC members. The GNOC group was requested for documentation on these tools, so we can share this information with the FG software committee.

vSMP: We are evaluating vSMP to be integrated into FG.

User Requirements Committee and User Advisory Board Summary

The first meeting of the FutureGrid User Advisory Board is targeting the TeraGrid 2010 conference in Pittsburgh, PA. Arrangements are underway for a full day meeting.

Early adopters to date who have registered to use FutureGrid resources include the following people (in no particular order):

1. Daniel LaPine NCSA
2. Ian Stokes-Rees Harvard
3. Shantenu Jha LSU
4. Katerina Stamou LSU
5. Harmut Kaiser LSU
6. Andre Merzky LSU
7. Jon Weissman University of Minnesota
8. Nick Edmonds Indiana University
9. Judy Qiu Indiana University
10. Andrea Matsunaga University of Florida
11. John Karpovich University of Virginia
12. Karolina Sarnowska University of Virginia
13. JP Navarro Argonne National Lab
14. Ian Gable University of Victoria, Canada
15. Steven Newhouse EGI
16. Amy Apon University of Arkansas
17. Martin Swany University of Delaware
18. Catherine Olschanowsky UCSD/SDSC
19. Jianwu Wang UCSD/SDSC
20. Kenneth Yoshimoto UCSD/SDSC
21. Mark Miller UCSD/SDSC
22. Subhashini Sivagnanam UCSD/SDSC
23. Tom Furlani University at Buffalo, SUNY
24. Troy Baer University of Tennessee
25. Jens-S. Vöckler USC/ISI
26. John Bresnahan University of Chicago
27. Paul Marshall University of Colorado

Performance Analysis Committee

Summary

During Q3, the Performance Analysis committee continued to refine and enhance our architecture document. The document was reformatted to comply with a new software template decided on by the Software Committee and new members of the group provided feedback as well. Now that other architecture documents are also available (e.g., Image Management), we are working to refine it further to address overlaps and gaps.

The group also continued to enhance the initial Inca deployment at <http://inca.futuregrid.org> for detecting functionality and performance problems on FutureGrid. The main enhancement was deploying HPCC as part of our automated benchmarking work to detect performance problems. New graphing interfaces were deployed to display the data in historical graphs and a new Inca reporter was developed to execute HPCC, process, and report the statistics. As group members worked to accept the new machines, we gathered their input files and deployed automated HPCC to the machine. This was also useful to verify working queue and compiler configurations after machine reinstalls. Currently, automated HPCC runs on all currently available machines with an HPC partition: India, Sierra, and Xray. This work was also shared with the new XD TAS group who is also using Inca. Other enhancements to the Inca deployment since the last report including deploying Inca to UF's Foxtrot machine and adding a placeholder for TACC's Tango machine. Also, temporary network tests were added to Sierra to capture and log a periodic connectivity problem that was reported to SDSC's networking group and subsequently resolved. The group also worked with the User Portal group to get some initial gadgets developed to display data collected by Inca.

The Performance Analysis Committee also decided to use Netlogger as an instrumentation API to passively collect performance and usage data from FutureGrid software components. This is a well-utilized tool and the ISI group members are also partnering with the Netlogger developer on another project, providing good access to consulting and support. An initial Netlogger deployment has been installed on inca.futuregrid.org and we have been testing it and working to configure it for FutureGrid, as well as performing some scalability testing. Once finished we will add documentation and instrument our own components to provide examples for the Software Committee.

Members of the group also hosted and attended a workshop at IU on the application performance analysis tool, Vampir on April 21st. The workshop was attended by about 15 participants and included an overview of the Vampir components as well as a hands-on tutorial session. Further details are at <http://iu-pti.org/hpa/vampir-workshop-2010>.

Inca: A bug fix to an Inca script used to submit batch jobs was made so that HPCC performance tests can be executed on Sierra. The HPCC performance tests will also be configured for the IU machine. A new report page to display HPCC output history via graphs was added to the Inca web pages. We pushed back HPCC performance test milestones to the end of July so we can include Tango from TACC.

Netlogger: Working on updating the Netlogger installation on inca.futuregrid.org to update yet the newest release. The Netlogger broker is integrated into inca.futuregrid.org and comes with `init.d` scripts, and the API libraries for Python, Perl and Java were re-installed

Training, Education, and Outreach Committee Summary

Educational virtual appliances: In the third quarter, the UF team has begun porting and testing its educational “Grid appliances” to the two cloud-provisioning technologies currently supported by FutureGrid – Eucalyptus and the Nimbus toolkit. This activity began with testing of the Grid appliance on University of Chicago’s Science Clouds, on UF’s “foxtrot” iDataPlex machine through Nimbus, and subsequently on IU’s “India” iDataPlex machine through Eucalyptus. The following tests have successfully been conducted so far:

- Deployment of Grid appliance clusters via Nimbus – we have been able to deploy a version of the Hadoop Grid appliance that uses packages built upon Ubuntu 9.04 on FutureGrid’s foxtrot. We have successfully deployed a small-scale 4-node virtual cluster connected through GroupVPN and running Hadoop through Nimbus command-line tools. Development is underway to create images based on Ubuntu 9.10.
- Deployment of Grid appliance via Eucalyptus – we have been able to deploy a version of the Condor Grid appliance that uses packages built upon Ubuntu 10.4 on FutureGrid’s india. We have successfully deployed a small-scale 4-node virtual cluster connected through GroupVPN to the public Grid appliance pool maintained by University of Florida. Development is under way to create images for Hadoop and MPI educational appliances to be made available through the image repository on FutureGrid

We have also developed documentation and tutorials on how to deploy educational appliances on FutureGrid using Nimbus and Eucalyptus, and how to install cloud client tools on a Grid appliance running on a user’s desktop.

Summary of EOT Events: Q1, Q2, and Q3

| Type of Event | | Title | Location | Presenter | Type of Audience | Month |
|-------------------------|----|--|--|---|--------------------|--------------|
| Workshops and Tutorials | Q1 | Introduction to the Grid Appliance | FutureGrid web site | University of Florida | On-line tutorial | Nov-Dec 2009 |
| | | Creating Grid Appliance clusters | FutureGrid web site | University of Florida | On-line tutorial | Nov-Dec 2009 |
| | | Building a Ubuntu-based Grid Appliance on cloud or local resources | FutureGrid web site | University of Florida | On-line tutorial | Nov-Dec 2009 |
| | | Deploying Grid Appliances using Nimbus | FutureGrid web site | University of Florida | On-line tutorial | Nov-Dec 2009 |
| | | Virtual MPI clusters with the Grid Appliance and MPICH2 | FutureGrid web site | University of Florida | On-line tutorial | Nov-Dec 2009 |
| | | Introduction to Hadoop using the Grid Appliance | FutureGrid web site | University of Florida | On-line tutorial | Nov-Dec 2009 |
| | Q2 | Performance Analysis Using the Vampir Toolchain | Innovation Center, Indiana University | Robert Henschel, Indiana University; Thomas William, ZIH, Dresden | Technical | April 2010 |
| Presentations and Talks | Q1 | FutureGrid | Open Grid Forum 27, Banff, Canada | Andrew Grimshaw, University of Virginia | Advanced technical | Oct 2009 |
| | | FutureGrid Overview | CCA-09 Cloud Computing and its Applications Workshop, Chicago, IL | Geoffrey Fox, Indiana University | Technical | Oct-2009 |
| | | FutureGrid and Green Aware Computing | Keynote at 3 rd International Conference on Networks & System Security, Gold Coast, Australia | Gregor von Laszewski, Indiana University | Technical | Oct 2009 |
| | | FutureGrid and Green Aware Computing | Northern Illinois University, DeKalb, IL | Gregor von Laszewski, Indiana University | Technical | Oct 2009 |
| | | FutureGrid: An Experimental High-Performance Grid Testbed | NCSA, Champaign-Urbana, IL | Craig Stewart, Indiana University | Technical | Oct 2009 |
| | | FutureGrid Overview | SC09 Conference, Indiana University booth, Portland, OR | Geoffrey Fox, Indiana University | Mixed technical | Nov 2009 |
| | | FutureGrid Overview | SC09 Conference, AIST booth, Portland, OR | Geoffrey Fox, Indiana University | Mixed technical | Nov 2009 |
| | | FutureGrid Overview | SC09 Conference, Indiana University booth, Portland, OR | Geoffrey Fox, Gregor von Laszewski, Marlon Pierce, Judy Qiu, Indiana University | Mixed technical | Nov 2009 |
| | | FutureGrid Cloud Technologies and Bioinformatics Applications | Keynote at 1 st International Conference, CloudCom 2009, Jiaotong University, Beijing, China | Geoffrey Fox, Indiana University | Mixed technical | Dec 2009 |
| | | Cloud Technologies and GeoScience Applications, including FutureGrid | International Symposium on Geo-Computation and Analysis (ISGA) 2009, Laboratory for Information Engineering in Surveying, Mapping and Remote Sensing (LIESMARS), Wuhan University, China | Geoffrey Fox, Indiana University | Technical | Dec 2009 |

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|-------------------------|----|---|--|--|------------------|------------|
| | | FutureGrid and Applications | Innovation Center, Indiana University | Geoffrey Fox, Indiana University | Mixed technical | Dec 2009 |
| Presentations and Talks | Q2 | Clouds and FutureGrid | All Hands Meeting, Minority Serving Institutions – Cyberinfrastructure Empowerment Coalition (MSI-CIEC), SDSC, San Diego, CA | Geoffrey Fox, Indiana University | Mixed technical | Jan 2010 |
| | | Building Effective CyberGIS: FutureGrid | National Science Foundation TeraGrid Workshop on Cyber-GIS, Washington, DC | Marlon Pierce and Geoffrey Fox, Indiana University | Technical | Feb 2010 |
| | | FutureGrid: An Experimental High-Performance Grid Testbed | TeraGrid Quarterly Meeting, Tampa, FL | Craig Stewart, Indiana University | Technical | Mar 2010 |
| | | FutureGrid Introduction | All Hands Meeting, Open Science Grid, Fermilab, Batavia, IL | Gregor von Laszewski, Indiana University | Technical | Mar 2010 |
| | Q3 | FutureGrid Introduction | Department of Energy, MAGIC virtual meeting | Gregor von Laszewski, Indiana University | Mixed technical | April 2010 |
| | | Cloud Technologies and Data Intensive Applications | Instrumenting the Grid (INGRID) Workshop, Poznan, Poland | Geoffrey Fox, Indiana University | Technical | May 2010 |
| | | Cloud Technologies and Their Applications | Keynote at 5 th International Workshop on Content Delivery Networks (CDN 2010) in The 10 th IEEE/ACM International Symposium on Cluster, Cloud, and Grid Computing (CCGrid) 2010, Melbourne, Victoria, Australia | Judy Qiu, Indiana University | | May 2010 |
| | | Sky Computing: When Multiple Clouds Become One | The 10 th IEEE/ACM International Symposium on Cluster, Cloud, and Grid Computing (CCGrid 2010), Melbourne, Victoria, Australia | Jose Fortes, University of Florida | Technical | May 2010 |
| | | Cloud Cyberinfrastructure and Collaboration | The 2010 International Symposium on Collaborative Technologies and Systems (CTS 2010), Westin Lombard Yorktown Center, Chicago, IL | Geoffrey Fox, Indiana University | Technical | May 2010 |
| | | FutureGrid | Venus-C, Brussels, Belgium | Geoffrey Fox, Indiana University | Technical | May 2010 |
| | | Algorithms and Applications for Grids and Clouds | 22 nd ACM Symposium on Parallelism in Algorithms and Architectures, Santorini, Greece | Geoffrey Fox, Indiana University | Technical | June 2010 |
| | | FutureGrid: Supporting Next Generation Cyberinfrastructure | The 4 th International Workshop on Virtualization Technologies in Distributed Computing (VTDC10) at HPDC, Chicago, IL | Geoffrey Fox, Indiana University | Technical | June 2010 |
| | | Cloud versus Cloud: How Will Cloud Computing Shape Our World? | Panel, HPDC, Chicago, IL | Geoffrey Fox, Indiana University | Mixed technical | June 2010 |
| | | Grids and Clouds for Cyberinfrastructure | Illinois Institute of Technology, Chicago, IL | Geoffrey Fox, Indiana University | Technical | June 2010 |

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|---------------|---|---|--|------------------|-----------|
| | Autonomic Computing Across Clouds | Grids Meet Autonomic Computing (GMAC), Washington, DC | Jose Fortes, University of Florida | Technical | June 2010 |
| | Sky Computing on FutureGrid and Grid'5000 | OGF-29, Chicago, IL | P. Riteau, et al., University of Florida | Technical | June 2010 |
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User Support Committee

General

All navigation pages under Help&Support are being moved into the FG Knowledge Base to make “search” functionality consistently available on all pages.

Initiated process for collecting and delivering information about planned and unplanned outages. Feedback from administrators indicate a preference for using email notification process, with posting to web and RSS feeds. Graphic displays from system and network monitoring tools will be integrated into the website as well.

Created draft of some communications for use within the account/project request process. Communication includes: what to expect working in a test-bed environment, availability of hardware and software, criteria for having a project accepted, a user's agreement/charter, citing research/presentations, how to get support.

FutureGrid Web Site

Work continues on the revision of the futuregrid.org site which will be an intermediate step on the way to the FutureGrid Portal. A planning document, proposed wireframe and sitemap have been created. Subpages are being built for the two key audiences -- , current and prospective researchers. The account and project requests forms will be revised to include additional communication material to manage expectations and describe the process. Additional upcoming tasks include the creation of a feedback form, implementation of the OG Forum module in Drupal, preparation of RSS feeds for news and announcements, and a system notices system.

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FutureGrid Knowledge Base

Active content in the FutureGridKB thru Q3 now includes:

- What is FutureGrid?
- About FutureGrid
- What is Inca?
- How does one get edit access to the FutureGrid web site (Drupal)?
- For FutureGrid, what committees are set up?
- On the FutureGrid site, how do I add myself to a committee?
- On the FutureGrid site event calendar, how do I add or remove an event?
- On the FutureGrid site, how do I add or change personal information?
- FutureGrid mailing lists are available and how do I use them?
- FutureGrid documentation
- Adding FGKB documents to Drupal
- About the FutureGrid SVN
- For the FutureGrid, how can I upload tasks into Jira from the command line?
- FutureGrid contact information (for Network Operations)
- Mailing list for FutureGrid network notifications
- Workflow plan for the FutureGrid - Global Research NOC service desk
- What hardware is part of FutureGrid, and where can I view information about its availability?
- How do I add a page to the FutureGrid Help & Support pages?
- How do I create a ticket for FutureGrid support?
- About network monitoring tools on the FutureGrid
- FutureGrid: Support information for VirtualAppliance Support information for VirtualAppliance
- How will FutureGrid help me do my research?
- For FutureGrid support, what standard reports are available in IU Research Technologies' Request Tracker (RT)?
- How do I contact FutureGrid?
- How can I register as a user of FutureGrid?
- Are there any RSS feeds available for FutureGrid news?
- FutureGrid Help & Support: Managing access to FutureGrid Help & Support: Managing access

- FutureGrid Help & Support: Running jobs Help & Support: Running jobs
- FutureGrid Help & Support: Data transfer and storage Help & Support: Data transfer and storage
- FutureGrid Help & Support: About FutureGrid Help & Support: About FutureGrid
- FutureGrid Help & Support: Network operations Help & Support: Network operations
- How can researchers or other users get accounts on FutureGrid machines?
- How do I build a virtual cluster appliance from Ubuntu 9.10 on EC2 or on a local appliance?
- What is the FutureGrid wiki and how can I get edit access to it?
- What is the FutureGrid JIRA site and how can I use it?
- How can people working on the FutureGrid project get accounts on FutureGrid machines?
- What resources are available for FutureGrid members and how can I access them?
- FutureGrid Help & Support: Internal support for FutureGrid team members Help & Support: Internal support for FutureGrid team members
- FutureGrid Help & Support: Training and education for FutureGrid Help & Support: Training and education
- FutureGrid Help & Support: Virtual machines on FutureGrid Help & Support: Virtual machines
- How can I view real-time network activity on the FutureGrid?
- How do I find information about outages and scheduled maintenance windows for the FutureGrid network?
- How can I view the current operational status of FutureGrid resources and services?
- FutureGrid Help & Support: Software and hardware Help & Support: Software and hardware
- On FutureGrid, how do I submit a job to the Cray XT5m? How do I submit a job to the Cray XT5m?
- How should I acknowledge the FutureGrid in my published work?
- Where can I find tutorials about technologies used on FutureGrid?
- Where can I find a topology map of the FutureGrid network?
- Where can I view FutureGrid network traffic graphs?
- How is the FutureGrid certificate authority run?
- When will FutureGrid begin using IPv6?
- For current researchers on FutureGrid For current researchers
- For prospective researchers on FutureGrid For prospective researchers

FutureGrid Quarterly Reports: Q3 2010 – 1 April to 30 June 2010

- How can I change the OS on a node to run a job?
- Who is eligible for FutureGrid accounts?
- For FutureGrid, how can I request a network impairment?
- What are the regularly scheduled maintenance activities on FutureGrid machines?
- On FutureGrid, how do I use Eucalyptus?

Operations & Change Management Committee Summary

- All subaward purchase orders finalized (Chicago, Florida, USC, San Diego, Texas, and Virginia)
- FutureGrid BOF abstract submitted to TeraGrid 2010 and accepted, to be combined with those from other new TeraGrid sites for an expanded session
- FutureGrid User Advisory Board meeting targeted for Monday, Aug 2nd at TeraGrid 2010
- Early adopter allocation process has been started. We have requests now for the Cray computer at Indiana
- UCSD, with help from IU, put forward an internal proposal for SDSC user Catherine Olschanowsky to attach a power monitoring harness to one node of the UCSD Sierra cluster. This experiment will incur a cost for IBM to recertify the node and the proposal was approved this week, first by the Operations committee and then by PI Fox.
- Proposal for collaboration with Cummins, Inc. to use FutureGrid endorsed by Operations Committee and forward to FutureGrid PI for approval

Expenditures Report Actuals thru June 30, 2010

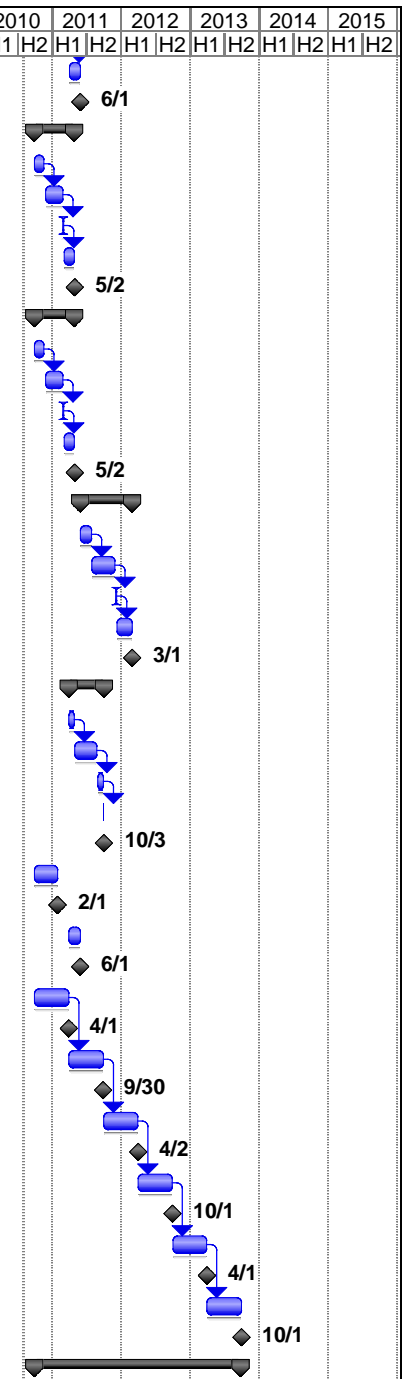
| Expenditures Report | Q1 | | Q2 | | Q3 | | TOTAL | |
|---|---------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------|
| | NSF \$ | Match \$ | NSF \$ | Match \$ | NSF \$ | Match \$ | NSF \$ | Match \$ |
| Total Salaries and Wages | 15,150 | 722 | 118,007 | 69,817 | 74,192 | 55,747 | 207,349 | 126,286 |
| Total Fringe Benefits | 3,489 | 51 | 37,081 | 27,531 | 25,759 | 21,837 | 66,329 | 49,419 |
| Total Salaries, Wages and Fringe Benefits | 18,639 | 773 | 155,088 | 97,348 | 99,951 | 77,584 | 273,678 | 175,705 |
| Total Equipment | 0 | 266,981 | 0 | 528,593 | 0 | 0 | 0 | 795,574 |
| Total Travel (Domestic) | 5,745 | 56 | 4,464 | 3,554 | 229 | 6,653 | 10,438 | 10,263 |
| Total Participant Support | 10,804 | 0 | 867 | 0 | 1,003 | 0 | 12,674 | 0 |
| Total Other Direct Costs | 0 | 32,288 | 0 | 48,047 | 65,542 | 68,378 | 65,542 | 148,713 |
| Subawards | 0 | 0 | 0 | 0 | 65,542 | 0 | 65,542 | 0 |
| Other (Networking, etc.) | 0 | 32,288 | 0 | 48,047 | | 68,378 | 0 | 148,713 |
| Total Direct Costs | 35,188 | 300,098 | 160,419 | 677,542 | 166,725 | 152,615 | 362,332 | 1,130,255 |
| Total Indirect Costs | 13,167 | 0 | 86,158 | 0 | 81,097 | 0 | 180,422 | 0 |
| Total Direct and Indirect | 48,355 | 300,098 | 246,577 | 677,542 | 247,822 | 152,615 | 542,754 | 1,130,255 |

Project Plan for Program Year 2

| ID | WBS | Task Name | Start | Finish | 09 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|----|---------|--|-------------|--------------|----|------|------|------|------|------|------|
| | | | | | H2 | H1 | H2 | H1 | H2 | H1 | H2 |
| 1 | 0 | FutureGrid Project | Thu 10/1/09 | Thu 10/1/09 | | | | | | | |
| 2 | 1.0 | Hardware | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 3 | 1.1 | Dell 1152 core | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 4 | 1.1.6 | Hardware maintenance - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 5 | 1.1.6.1 | Upgrade FutureGrid software - PY2 H1 | Fri 10/1/10 | Thu 3/31/11 | | | | | | | |
| 6 | 1.1.6.2 | Upgrade FutureGrid software - PY2 H2 | Fri 4/1/11 | Fri 9/30/11 | | | | | | | |
| 7 | 1.1.7 | Hardware refresh - PY3 | Mon 10/3/11 | Fri 9/28/12 | | | | | | | |
| 8 | 1.1.8 | Hardware refresh - PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 9 | 1.2 | IBM iDataPlex 1024 core | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 10 | 1.2.6 | Hardware maintenance - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 11 | 1.2.6.1 | Upgrade FutureGrid software - PY2 H1 | Fri 10/1/10 | Thu 3/31/11 | | | | | | | |
| 12 | 1.2.6.2 | Upgrade FutureGrid software - PY2 H2 | Fri 4/1/11 | Fri 9/30/11 | | | | | | | |
| 13 | 1.2.6.3 | Add memory/nodes to IU iDataPlex | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 14 | 1.2.7 | Hardware refresh - PY3 | Mon 10/3/11 | Fri 9/28/12 | | | | | | | |
| 15 | 1.2.8 | Hardware refresh - PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 16 | 1.3 | IBM iDataPlex 672 core | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 17 | 1.3.6 | Hardware maintenance - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 18 | 1.3.6.1 | Upgrade FutureGrid software - PY2 H1 | Fri 10/1/10 | Thu 3/31/11 | | | | | | | |
| 19 | 1.3.6.2 | Upgrade FutureGrid software - PY2 H2 | Fri 4/1/11 | Fri 9/30/11 | | | | | | | |
| 20 | 1.3.7 | Hardware refresh - PY3 | Mon 10/3/11 | Fri 9/28/12 | | | | | | | |
| 21 | 1.3.8 | Hardware refresh - PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 22 | 1.4 | IBM iDataPlex 256 core | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 23 | 1.4.6 | Hardware maintenance - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 24 | 1.4.6.1 | Upgrade FutureGrid software - PY2 H1 | Fri 10/1/10 | Thu 3/31/11 | | | | | | | |
| 25 | 1.4.6.2 | Upgrade FutureGrid software - PY2 H2 | Fri 4/1/11 | Fri 9/30/11 | | | | | | | |
| 26 | 1.4.6.3 | Storage upgrade | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 27 | 1.4.7 | Hardware refresh - PY3 | Mon 10/3/11 | Fri 9/28/12 | | | | | | | |
| 28 | 1.4.8 | Hardware refresh - PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 29 | 1.5 | Cray XT5M 672 core | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 30 | 1.5.6 | Hardware maintenance - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 31 | 1.5.6.1 | Upgrade FutureGrid software - PY2 H1 | Fri 10/1/10 | Thu 3/31/11 | | | | | | | |
| 32 | 1.5.6.2 | Upgrade FutureGrid software - PY2 H2 | Fri 4/1/11 | Fri 9/30/11 | | | | | | | |
| 33 | 1.5.6.3 | Add IO node for Lustre file system and dynamic library support | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 34 | 1.5.7 | Hardware refresh - PY3 | Mon 10/3/11 | Fri 9/28/12 | | | | | | | |
| 35 | 1.5.8 | Hardware refresh - PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 36 | 1.6 | Shared Memory cluster | Mon 11/1/10 | Thu 6/30/11 | | | | | | | |
| 37 | 1.6.1 | Hardware configurations finalized | Mon 11/1/10 | Tue 11/30/10 | | | | | | | |
| 38 | 1.6.2 | Vendor purchase orders finalized | Wed 12/1/10 | Thu 12/30/10 | | | | | | | |
| 39 | 1.6.3 | Site preparation | Wed 1/5/11 | Fri 1/28/11 | | | | | | | |
| 40 | 1.6.4 | Hardware acquisition | Wed 2/2/11 | Fri 4/1/11 | | | | | | | |
| 41 | 1.6.4.1 | Pre-shipment review | Wed 2/2/11 | Thu 2/3/11 | | | | | | | |
| 42 | 1.6.4.2 | Cabinets, racks, etc. installed | Mon 2/7/11 | Fri 2/11/11 | | | | | | | |
| 43 | 1.6.4.3 | Hardware received | Mon 2/14/11 | Tue 2/15/11 | | | | | | | |

| ID | WBS | Task Name | Start | Finish | 09 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|----|----------------|---|--------------------|---------------------|----|------|------|------|------|------|------|
| | | | | | H2 | H1 | H2 | H1 | H2 | H1 | H2 |
| 44 | 1.6.4.4 | Hardware installed | Wed 2/16/11 | Fri 3/11/11 | | | | | | | |
| 45 | 1.6.4.5 | Hardware networked | Mon 3/14/11 | Fri 4/1/11 | | | | | | | |
| 46 | 1.6.5 | Commissioning | Mon 3/14/11 | Thu 6/30/11 | | | | | | | |
| 47 | 1.6.5.1 | Acceptance test | Mon 3/14/11 | Fri 4/29/11 | | | | | | | |
| 48 | 1.6.5.2 | FutureGrid software environment installed/configured | Mon 5/2/11 | Fri 5/13/11 | | | | | | | |
| 49 | 1.6.5.3 | System test Future Grid software environment | Mon 5/16/11 | Fri 6/17/11 | | | | | | | |
| 50 | 1.6.5.4 | Transition to operations | Mon 6/20/11 | Thu 6/30/11 | | | | | | | |
| 51 | 2.6.6 | Shared Memory cluster completed | Thu 6/30/11 | Thu 6/30/11 | | | | | | | |
| 52 | 1.7 | IBM iDataPlex 672 core | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 53 | 1.7.6 | Hardware maintenance - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 54 | 1.7.6.1 | Upgrade FutureGrid software - PY2 H1 | Fri 10/1/10 | Thu 3/31/11 | | | | | | | |
| 55 | 1.7.6.2 | Upgrade FutureGrid software - PY2 H2 | Fri 4/1/11 | Fri 9/30/11 | | | | | | | |
| 56 | 1.7.7 | Hardware refresh - PY3 | Mon 10/3/11 | Fri 9/28/12 | | | | | | | |
| 57 | 1.7.8 | Hardware refresh - PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 58 | 1.8 | Purdue "High Throughput" Cluster | Fri 10/1/10 | Mon 10/3/11 | | | | | | | |
| 59 | 1.8.1 | Purdue 96-node cluster ready for users | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 60 | 1.8.2 | Purdue small FPGA cluster ready for users | Mon 10/3/11 | Mon 10/3/11 | | | | | | | |
| 61 | 1.11 | HPSS | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 62 | 1.11.1 | Procure additional tapes - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 63 | 1.11.2 | procure additional tapes - PY3 | Mon 10/3/11 | Fri 9/28/12 | | | | | | | |
| 64 | 1.11.3 | Procure additional tapes - PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 65 | 2.0 | Networks | Mon 2/1/10 | Fri 10/29/10 | | | | | | | |
| 66 | 2.6 | Provision connectivity to existing TeraGrid and Internet2 | Mon 2/1/10 | Fri 10/29/10 | | | | | | | |
| 67 | 3.2 | TeraGrid2 and Internet2 connectivity completed | Fri 10/29/10 | Fri 10/29/10 | | | | | | | |
| 68 | 3 | Software | Thu 4/1/10 | Tue 10/1/13 | | | | | | | |
| 69 | 3.1 | AMIE | Fri 7/1/11 | Thu 9/29/11 | | | | | | | |
| 70 | 3.1.1 | Review TeraGrid processes | Fri 7/1/11 | Fri 7/15/11 | | | | | | | |
| 71 | 3.1.2 | Establish feed from FutureGrid to AMIE | Mon 7/18/11 | Fri 7/29/11 | | | | | | | |
| 72 | 3.1.3 | Test data feed from FutureGrid to AMIE | Mon 8/1/11 | Tue 8/30/11 | | | | | | | |
| 73 | 3.1.4 | Implement data feed from FutureGrid to AMIE | Thu 9/1/11 | Thu 9/29/11 | | | | | | | |
| 74 | 4.2 | FutureGrid feed to AMIE complete | Fri 9/30/11 | Fri 9/30/11 | | | | | | | |
| 75 | 3.2 | User Portal | Mon 7/5/10 | Tue 10/1/13 | | | | | | | |
| 76 | 3.2.2 | Experiment Management Services | Mon 7/5/10 | Thu 3/1/12 | | | | | | | |
| 77 | 3.2.2.1 | Image Browser | Mon 7/5/10 | Mon 2/28/11 | | | | | | | |
| 78 | 3.2.2.1.1 | Design | Mon 7/5/10 | Tue 8/31/10 | | | | | | | |
| 79 | 3.2.2.1.2 | Iterate | Mon 9/6/10 | Fri 1/7/11 | | | | | | | |
| 80 | 3.2.2.1.3 | Deploy | Mon 1/10/11 | Fri 1/14/11 | | | | | | | |
| 81 | 3.2.2.1.4 | Refine | Mon 1/17/11 | Mon 2/28/11 | | | | | | | |
| 82 | 4.3.1.2 | Image Browser completed | Tue 3/1/11 | Tue 3/1/11 | | | | | | | |
| 83 | 3.2.2.2 | Experiment Browser | Mon 10/4/10 | Tue 5/31/11 | | | | | | | |
| 84 | 3.2.2.2.1 | Design | Mon 10/4/10 | Fri 12/3/10 | | | | | | | |
| 85 | 3.2.2.2.2 | Iterate | Mon 12/6/10 | Fri 3/25/11 | | | | | | | |
| 86 | 3.2.2.2.3 | Deploy | Mon 3/28/11 | Fri 4/1/11 | | | | | | | |

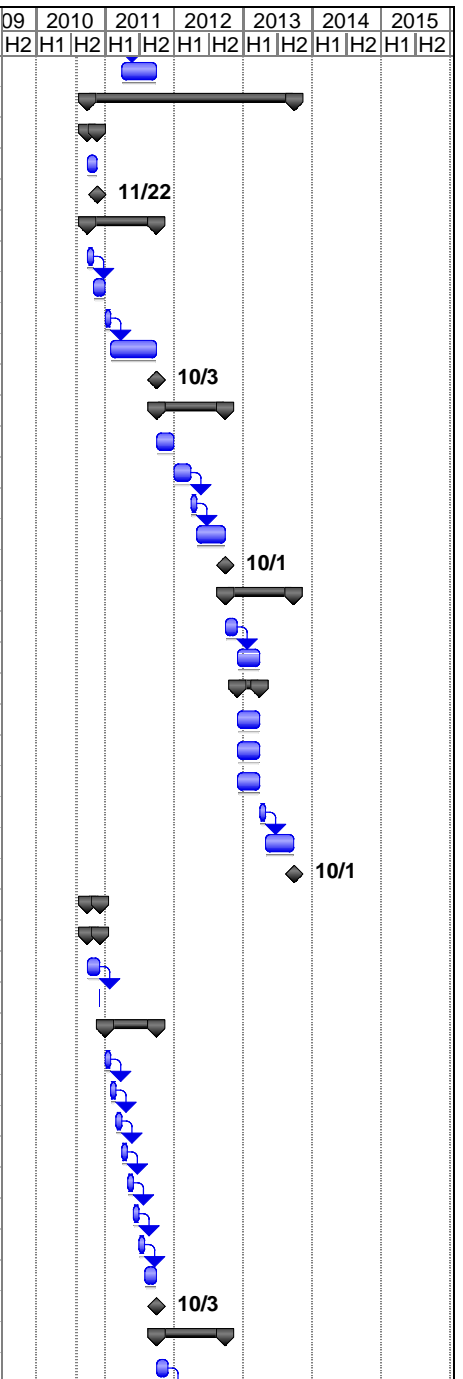
| ID | WBS | Task Name | Start | Finish | 09 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-----|----------------|--|--------------------|--------------------|----|------|------|------|------|------|------|
| | | | | | H2 | H1 | H2 | H1 | H2 | H1 | H2 |
| 87 | 3.2.2.2.4 | Refine | Mon 4/4/11 | Tue 5/31/11 | | | | | | | |
| 88 | 4.3.1.4 | Experiment Browser completed | Wed 6/1/11 | Wed 6/1/11 | | | | | | | |
| 89 | 3.2.2.3 | Software Configuration Browser | Fri 10/1/10 | Fri 4/29/11 | | | | | | | |
| 90 | 3.2.2.3.1 | Design | Fri 10/1/10 | Fri 11/19/10 | | | | | | | |
| 91 | 3.2.2.3.2 | Iterate | Mon 11/29/10 | Mon 2/28/11 | | | | | | | |
| 92 | 3.2.2.3.3 | Deploy | Tue 3/1/11 | Fri 3/4/11 | | | | | | | |
| 93 | 3.2.2.3.4 | Refine | Mon 3/7/11 | Fri 4/29/11 | | | | | | | |
| 94 | 4.3.1.6 | Software Configuration Browser completed | Mon 5/2/11 | Mon 5/2/11 | | | | | | | |
| 95 | 3.2.2.4 | Monitoring/Instrumentation Browser | Fri 10/1/10 | Fri 4/29/11 | | | | | | | |
| 96 | 3.2.2.4.1 | Design | Fri 10/1/10 | Fri 11/19/10 | | | | | | | |
| 97 | 3.2.2.4.2 | Iterate | Mon 11/29/10 | Mon 2/28/11 | | | | | | | |
| 98 | 3.2.2.4.3 | Deploy | Tue 3/1/11 | Fri 3/4/11 | | | | | | | |
| 99 | 3.2.2.4.4 | Refine | Mon 3/7/11 | Fri 4/29/11 | | | | | | | |
| 100 | 4.3.1.8 | Monitoring/Instrumentation Browser completed | Mon 5/2/11 | Mon 5/2/11 | | | | | | | |
| 101 | 3.2.2.5 | Scheduling, reservations | Wed 6/1/11 | Wed 2/29/12 | | | | | | | |
| 102 | 3.2.2.5.1 | Design | Wed 6/1/11 | Fri 7/29/11 | | | | | | | |
| 103 | 3.2.2.5.2 | Iterate | Mon 8/1/11 | Wed 11/30/11 | | | | | | | |
| 104 | 3.2.2.5.3 | Deploy | Mon 12/5/11 | Fri 12/9/11 | | | | | | | |
| 105 | 3.2.2.5.4 | Refine | Mon 12/12/11 | Wed 2/29/12 | | | | | | | |
| 106 | 4.3.1.10 | Scheduling, reservations completed | Thu 3/1/12 | Thu 3/1/12 | | | | | | | |
| 107 | 3.2.2.6 | Storage services | Fri 4/1/11 | Mon 10/3/11 | | | | | | | |
| 108 | 3.2.2.6.1 | Design | Fri 4/1/11 | Fri 4/29/11 | | | | | | | |
| 109 | 3.2.2.6.2 | Iterate | Mon 5/2/11 | Fri 8/26/11 | | | | | | | |
| 110 | 3.2.2.6.3 | Deploy | Thu 9/1/11 | Fri 9/30/11 | | | | | | | |
| 111 | 3.2.2.6.4 | Refine | Mon 10/3/11 | Mon 10/3/11 | | | | | | | |
| 112 | 4.3.1.12 | Storage services completed | Mon 10/3/11 | Mon 10/3/11 | | | | | | | |
| 113 | 3.2.3 | View/manage user/group information | Fri 10/1/10 | Mon 1/31/11 | | | | | | | |
| 114 | 4.3.3 | Portal user information management completed | Tue 2/1/11 | Tue 2/1/11 | | | | | | | |
| 115 | 3.2.4 | Test harness access | Fri 4/1/11 | Tue 5/31/11 | | | | | | | |
| 116 | 4.3.5 | Portal access to test harness completed | Wed 6/1/11 | Wed 6/1/11 | | | | | | | |
| 117 | 3.2.5 | Portal maintenance - PY2 H1 | Fri 10/1/10 | Thu 3/31/11 | | | | | | | |
| 118 | 4.3.7 | Portal maintenance - PY2 H1 completed | Fri 4/1/11 | Fri 4/1/11 | | | | | | | |
| 119 | 3.2.6 | Portal maintenance - PY2 H2 | Fri 4/1/11 | Fri 9/30/11 | | | | | | | |
| 120 | 4.3.9 | Portal maintenance - PY2 H2 completed | Fri 9/30/11 | Fri 9/30/11 | | | | | | | |
| 121 | 3.2.7 | Portal maintenance - PY3 H1 | Mon 10/3/11 | Fri 3/30/12 | | | | | | | |
| 122 | 4.3.11 | Portal maintenance - PY3 H1 completed | Mon 4/2/12 | Mon 4/2/12 | | | | | | | |
| 123 | 3.2.8 | Portal maintenance - PY3 H2 | Mon 4/2/12 | Fri 9/28/12 | | | | | | | |
| 124 | 4.3.13 | Portal maintenance - PY3 H2 completed | Mon 10/1/12 | Mon 10/1/12 | | | | | | | |
| 125 | 3.2.9 | Portal maintenance - PY4 H1 | Wed 10/3/12 | Fri 3/29/13 | | | | | | | |
| 126 | 4.3.15 | Portal maintenance - PY4 H1 completed | Mon 4/1/13 | Mon 4/1/13 | | | | | | | |
| 127 | 3.2.10 | Portal maintenance - PY4 H2 | Mon 4/1/13 | Mon 9/30/13 | | | | | | | |
| 128 | 4.3.17 | Portal maintenance - PY4 H2 completed | Tue 10/1/13 | Tue 10/1/13 | | | | | | | |
| 129 | 3.3 | Pegasus | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |



| ID | WBS | Task Name | Start | Finish | 09 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-----|---------|---|--------------------|--------------------|----|------|------|------|------|------|------|
| | | | | | H2 | H1 | H2 | H1 | H2 | H1 | H2 |
| 130 | 3.3.3 | Immediate resource provisioning workflow | Fri 10/1/10 | Tue 11/30/10 | | | | | | | |
| 131 | 3.3.6 | Pegasus tutorial | Fri 10/1/10 | Fri 12/17/10 | | | | | | | |
| 132 | 3.3.5 | Workflow repository requirements | Fri 10/1/10 | Fri 12/31/10 | | | | | | | |
| 133 | 3.3.4 | Time-sensitive resource provisioning workflow | Mon 1/3/11 | Fri 9/30/11 | | | | | | | |
| 134 | 3.3.7 | End-to-end experiment management workflows | Mon 10/3/11 | Thu 9/27/12 | | | | | | | |
| 135 | 3.3.8 | Workflow repository | Tue 10/4/11 | Thu 2/28/13 | | | | | | | |
| 136 | 3.3.2 | Pegasus documentation maintenance | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 137 | 3.3.9 | Pegasus maintenance - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 138 | 3.3.9 | Pegasus maintenance - PY3 | Tue 10/4/11 | Fri 9/28/12 | | | | | | | |
| 139 | 4.4.10 | Pegasus maintenance - PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 140 | 3.4 | Grid Benchmark Challenge | Fri 10/1/10 | Fri 6/28/13 | | | | | | | |
| 141 | 3.4.1 | Performance API supported at all FutureGrid sites | Fri 10/1/10 | Fri 12/17/10 | | | | | | | |
| 142 | 3.4.2 | HPCC benchmark with Globus/MPICH-G | Fri 10/1/10 | Thu 3/31/11 | | | | | | | |
| 143 | 3.4.3 | Modifications of HPCC network tests for cross-site execution completed | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 144 | 3.4.4 | Modifications of local computational tests of HPCC benchmark completed | Mon 10/3/11 | Fri 12/30/11 | | | | | | | |
| 145 | 3.4.5 | Modifications of global computational tests of HPCC benchmark completed | Mon 1/2/12 | Thu 9/27/12 | | | | | | | |
| 146 | 3.4.6 | Virtualization of HPCC benchmark completed | Mon 10/1/12 | Fri 3/29/13 | | | | | | | |
| 147 | 3.4.7 | Heterogeneous virtualization of HPCC benchmark completed | Tue 4/3/12 | Fri 6/28/13 | | | | | | | |
| 148 | 3.5 | Inca | Fri 10/1/10 | Mon 9/30/13 | | | | | | | |
| 149 | 3.5.1.4 | Add additional tests as new software is added or updated | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 150 | 3.5.1.5 | Support NSF required and optional benchmarks | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 151 | 3.5.1.3 | User documentation maintenance | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 152 | 3.5.1.6 | Integrate verification processes into Image Management | Mon 11/1/10 | Fri 9/30/11 | | | | | | | |
| 153 | 3.5.1.7 | Extend automated benchmarking into virtual environments | Tue 1/4/11 | Fri 9/30/11 | | | | | | | |
| 154 | 3.5.3 | Inca enhancements - PY3 | Tue 10/4/11 | Fri 9/28/12 | | | | | | | |
| 155 | 3.5.4 | Inca enhancements - PY4 | Wed 10/3/12 | Mon 9/30/13 | | | | | | | |
| 156 | 3.6 | Nimbus | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 157 | 3.6.2 | Nimbus maintenance - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 158 | 3.6.2.1 | Collect user requirements | Fri 10/1/10 | Tue 11/30/10 | | | | | | | |
| 159 | 3.6.2.2 | Develop, test, implement new FG-driven release - PY2 H1 | Wed 12/1/10 | Thu 3/31/11 | | | | | | | |
| 160 | 3.6.2.1 | Collect user requirements | Fri 4/1/11 | Tue 5/31/11 | | | | | | | |
| 161 | 3.6.2.2 | Develop, test, implement new FG-driven release - PY2 H2 | Wed 6/1/11 | Fri 9/30/11 | | | | | | | |
| 162 | 3.6.3 | Nimbus maintenance - PY3 | Tue 10/4/11 | Fri 9/28/12 | | | | | | | |
| 163 | 3.6.4 | Nimbus maintenance - PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 164 | 3.7 | Actuating Services | Fri 10/1/10 | Mon 1/2/12 | | | | | | | |
| 165 | 3.7.1 | Components | Fri 10/1/10 | Mon 1/2/12 | | | | | | | |
| 166 | 3.7.1.2 | bcfg2 | Fri 10/1/10 | Fri 12/10/10 | | | | | | | |
| 167 | 3.7.1.4 | Moab deployments | Fri 10/1/10 | Wed 12/22/10 | | | | | | | |
| 168 | 4.8.2 | FutureGrid components completed | Fri 12/31/10 | Fri 12/31/10 | | | | | | | |
| 169 | 3.7.1.5 | Moab maintenance - PY2 H1 | Mon 1/3/11 | Fri 7/1/11 | | | | | | | |
| 170 | 3.7.1.6 | Moab maintenance - PY2 H2 | Mon 7/4/11 | Mon 1/2/12 | | | | | | | |
| 171 | 3.7.2 | Instantiations | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 172 | 4.8.3.4 | Xen maintenance - PY2 H1 | Fri 10/1/10 | Thu 3/31/11 | | | | | | | |

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| ID | WBS | Task Name | Start | Finish | 09 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-----|-----------|--|--------------|--------------|----|------|------|------|------|------|------|
| | | | | | H2 | H1 | H2 | H1 | H2 | H1 | H2 |
| 173 | 4.8.3.5 | Xen maintenance - PY2 H2 | Fri 4/1/11 | Fri 9/30/11 | | | | | | | |
| 174 | 3.8 | ViNe | Fri 10/1/10 | Tue 10/1/13 | | | | | | | |
| 175 | 3.8.1 | ViNe routing software | Fri 10/1/10 | Fri 11/19/10 | | | | | | | |
| 176 | 3.8.1.6 | Refine ViNe from user feedback | Fri 10/1/10 | Fri 11/19/10 | | | | | | | |
| 177 | 4.9.2 | ViNe routing API and middleware completed | Mon 11/22/10 | Mon 11/22/10 | | | | | | | |
| 178 | 3.8.2 | ViNe management interfaces | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 179 | 3.8.2.1 | Requirements analysis on overlay virtual networks | Fri 10/1/10 | Mon 11/1/10 | | | | | | | |
| 180 | 3.8.2.2 | Develop/integrate management capabilities | Tue 11/2/10 | Fri 12/31/10 | | | | | | | |
| 181 | 3.8.2.3 | Deploy ViNe | Tue 1/4/11 | Mon 1/31/11 | | | | | | | |
| 182 | 3.8.2.4 | Refine ViNe from user feedback | Tue 2/1/11 | Fri 9/30/11 | | | | | | | |
| 183 | 4.9.4 | ViNe management interfaces completed | Mon 10/3/11 | Mon 10/3/11 | | | | | | | |
| 184 | 3.8.3 | ViNe management services | Mon 10/3/11 | Fri 9/28/12 | | | | | | | |
| 185 | 3.8.3.1 | Requirements analysis on automated overlay networks management | Mon 10/3/11 | Fri 12/30/11 | | | | | | | |
| 186 | 3.8.3.2 | Develop/integrate management capabilities | Tue 1/3/12 | Fri 3/30/12 | | | | | | | |
| 187 | 3.8.3.3 | Deploy ViNe | Mon 4/2/12 | Mon 4/30/12 | | | | | | | |
| 188 | 3.8.3.4 | Refine ViNe from user feedback | Tue 5/1/12 | Fri 9/28/12 | | | | | | | |
| 189 | 4.9.6 | ViNe management services completed | Mon 10/1/12 | Mon 10/1/12 | | | | | | | |
| 190 | 3.8.4 | ViNe routing and services improvements | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 191 | 3.8.4.1 | Collect enhancement requests and bug reports | Mon 10/1/12 | Fri 11/30/12 | | | | | | | |
| 192 | 3.8.4.2 | Develop new features and provide bug fixes | Mon 12/3/12 | Fri 3/29/13 | | | | | | | |
| 193 | 3.8.4.3 | Development high-level services using deployed APIs | Mon 12/3/12 | Fri 3/29/13 | | | | | | | |
| 194 | 3.8.4.3.1 | Monitoring and automatic recovery during network outages | Mon 12/3/12 | Fri 3/29/13 | | | | | | | |
| 195 | 3.8.4.3.2 | Self-optimization of communication performance | Mon 12/3/12 | Fri 3/29/13 | | | | | | | |
| 196 | 3.8.4.3.3 | End-to-end QoS | Mon 12/3/12 | Fri 3/29/13 | | | | | | | |
| 197 | 3.8.4.4 | Deploy ViNe | Mon 4/1/13 | Tue 4/30/13 | | | | | | | |
| 198 | 3.8.4.5 | Refine ViNe from user feedback | Wed 5/1/13 | Thu 9/26/13 | | | | | | | |
| 199 | 4.9.8 | ViNe routing and services improvements completed | Tue 10/1/13 | Tue 10/1/13 | | | | | | | |
| 200 | 3.9 | Virtual appliance | Fri 10/1/10 | Mon 12/6/10 | | | | | | | |
| 201 | 3.9.1 | Initial version | Fri 10/1/10 | Mon 12/6/10 | | | | | | | |
| 202 | 3.9.1.9 | Refine virtual appliance from user feedback | Fri 10/1/10 | Fri 12/3/10 | | | | | | | |
| 203 | 3.9.1.10 | Update tutorial/video/documenation | Mon 12/6/10 | Mon 12/6/10 | | | | | | | |
| 204 | 3.9.2 | Education modules | Mon 1/3/11 | Fri 9/30/11 | | | | | | | |
| 205 | 3.9.2.1 | Develop 1-2 core educational modules | Mon 1/3/11 | Mon 1/31/11 | | | | | | | |
| 206 | 3.9.2.2 | Test modules | Tue 2/1/11 | Mon 2/28/11 | | | | | | | |
| 207 | 3.9.2.3 | Deploy virtual appliance | Tue 3/1/11 | Thu 3/31/11 | | | | | | | |
| 208 | 3.9.2.4 | Refine virtual appliance from user feedback | Fri 4/1/11 | Fri 4/29/11 | | | | | | | |
| 209 | 3.9.2.5 | Develop 1-2 core educational modules | Mon 5/2/11 | Tue 5/31/11 | | | | | | | |
| 210 | 3.9.2.6 | Test modules | Wed 6/1/11 | Thu 6/30/11 | | | | | | | |
| 211 | 3.9.2.7 | Deploy virtual appliance | Fri 7/1/11 | Fri 7/29/11 | | | | | | | |
| 212 | 3.9.2.8 | Refine virtual appliance from user feedback | Mon 8/1/11 | Fri 9/30/11 | | | | | | | |
| 213 | 4.12 | Education modules and updated tutorial/video completed | Mon 10/3/11 | Mon 10/3/11 | | | | | | | |
| 214 | 3.9.3 | Virtual appliance enhancements - PY3 | Mon 10/3/11 | Fri 9/28/12 | | | | | | | |
| 215 | 3.9.3.1 | Collect enhancement requests and bug reports | Mon 10/3/11 | Wed 11/30/11 | | | | | | | |



| ID | WBS | Task Name | Start | Finish | 09 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-----|----------|---|-------------|--------------|----|------|------|------|------|------|------|
| | | | | | H2 | H1 | H2 | H1 | H2 | H1 | H2 |
| 216 | 3.9.3.2 | Develop new features and provide bug fixes | Mon 12/5/11 | Thu 3/29/12 | | | | | | | |
| 217 | 3.9.3.3 | Deploy virtual appliance | Mon 4/2/12 | Mon 4/30/12 | | | | | | | |
| 218 | 3.9.3.4 | Refine virtual appliance from user feedback | Tue 5/1/12 | Fri 9/28/12 | | | | | | | |
| 219 | 3.9.3.5 | Update tutorial/video/documentation | Tue 5/1/12 | Fri 9/28/12 | | | | | | | |
| 220 | 4.14 | Virtual appliance enhancements and updated tutorial/video completed | Mon 10/1/12 | Mon 10/1/12 | | | | | | | |
| 221 | 3.9.4 | Virtual appliance enhancements - PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 222 | 3.9.4.1 | Collect enhancement requests and bug reports | Mon 10/1/12 | Fri 11/30/12 | | | | | | | |
| 223 | 3.9.4.2 | Develop new features and provide bug fixes | Mon 12/3/12 | Fri 3/29/13 | | | | | | | |
| 224 | 3.9.4.3 | Deploy virtual appliance | Mon 4/1/13 | Tue 4/30/13 | | | | | | | |
| 225 | 3.9.4.4 | Refine virtual appliance from user feedback | Wed 5/1/13 | Thu 9/26/13 | | | | | | | |
| 226 | 3.9.4.5 | Update tutorial/video/documentation | Wed 5/1/13 | Thu 9/26/13 | | | | | | | |
| 227 | 4.16 | Virtual appliance enhancements and updated tutorial/video completed | Tue 10/1/13 | Tue 10/1/13 | | | | | | | |
| 228 | 3.10 | Test Harness | Wed 9/1/10 | Tue 10/1/13 | | | | | | | |
| 229 | 3.10.1 | Initial Version | Wed 9/1/10 | Tue 11/30/10 | | | | | | | |
| 230 | 3.10.1.4 | Iteration Alpha 2 | Wed 9/1/10 | Thu 9/30/10 | | | | | | | |
| 231 | 3.10.1.5 | Iteration Beta | Fri 10/1/10 | Fri 10/29/10 | | | | | | | |
| 232 | 3.10.1.6 | Systems integration | Mon 11/1/10 | Tue 11/30/10 | | | | | | | |
| 233 | 3.10.1.7 | Documentation | Mon 11/1/10 | Tue 11/30/10 | | | | | | | |
| 234 | 4.17.2 | Initial test harness with limited functionality completed | Wed 12/1/10 | Wed 12/1/10 | | | | | | | |
| 235 | 3.10.2 | Logging | Fri 10/1/10 | Fri 4/1/11 | | | | | | | |
| 236 | 4.17.4 | Test harness logging completed | Fri 4/1/11 | Fri 4/1/11 | | | | | | | |
| 237 | 3.10.3 | Web Interface | Mon 5/2/11 | Fri 9/30/11 | | | | | | | |
| 238 | 4.17.6 | Web interface completed | Mon 10/3/11 | Mon 10/3/11 | | | | | | | |
| 239 | 3.10.4 | Test harness maintenance - PY2 H1 | Fri 4/1/11 | Fri 4/1/11 | | | | | | | |
| 240 | 3.10.5 | Test harness maintenance - PY2 H2 | Mon 10/3/11 | Mon 10/3/11 | | | | | | | |
| 241 | 3.10.6 | Test harness maintenance - PY3 H1 | Mon 4/2/12 | Mon 4/2/12 | | | | | | | |
| 242 | 3.10.7 | Test harness maintenance - PY3 H2 | Mon 10/1/12 | Mon 10/1/12 | | | | | | | |
| 243 | 3.10.8 | Test harness maintenance - PY4 H1 | Mon 4/1/13 | Mon 4/1/13 | | | | | | | |
| 244 | 3.10.9 | Test harness maintenance - PY4 H2 | Tue 10/1/13 | Tue 10/1/13 | | | | | | | |
| 245 | 3.11 | Genesis II, UNICORE, and gLite | Thu 4/1/10 | Mon 9/30/13 | | | | | | | |
| 246 | 3.11.3 | Deploy UNICORE, and gLite on FutureGrid nodes | Thu 4/1/10 | Thu 9/30/10 | | | | | | | |
| 247 | 4.18.2 | Deploy Genesis II on FutureGrid nodes | Thu 4/1/10 | Thu 9/30/10 | | | | | | | |
| 248 | 4.18.3 | Deploy standard service endpoints for compliance testing | Tue 8/3/10 | Thu 9/30/10 | | | | | | | |
| 249 | 4.18.4 | Genesis II, UNICORE, and gLite deployments completed | Fri 10/1/10 | Fri 10/1/10 | | | | | | | |
| 250 | 3.11.6 | Genesis II, UNICORE, and gLite maintenance - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 251 | 3.11.7 | Genesis II, UNICORE, and gLite maintenance - PY3 | Mon 10/3/11 | Thu 9/27/12 | | | | | | | |
| 252 | 3.11.8 | Genesis II, UNICORE, and gLite maintenance - PY4 | Wed 10/3/12 | Mon 9/30/13 | | | | | | | |
| 253 | 3.12 | Vampir | Fri 10/1/10 | Fri 9/28/12 | | | | | | | |
| 254 | 3.12.3 | Vampir maintenance - PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 255 | 3.12.4 | Vampir maintenance - PY3 | Tue 10/4/11 | Fri 9/28/12 | | | | | | | |
| 256 | 3.13 | Eucalyptus | Fri 10/1/10 | Fri 11/12/10 | | | | | | | |
| 257 | 3.13.1 | Eucalyptus upgrade - PY2 | Fri 10/1/10 | Fri 11/12/10 | | | | | | | |
| 258 | 4 | Operations | Fri 10/1/10 | Fri 9/26/14 | | | | | | | |

| ID | WBS | Task Name | Start | Finish | 09 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-----|---------|---|--------------|--------------|----|------|------|------|------|------|------|
| | | | | | H2 | H1 | H2 | H1 | H2 | H1 | H2 |
| 259 | 4.1 | User Support | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 260 | 4.1.1 | Global research NOC network monitoring | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 261 | 4.1.2 | IU Knowledge Base | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 262 | 4.1.2.2 | IU KB entries created - Program Year 2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 263 | 4.1.2.3 | IU KB entries created - Program Year 3 | Mon 10/3/11 | Thu 9/27/12 | | | | | | | |
| 264 | 4.1.2.4 | IU KB entries created - Program Year 4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 265 | 4.1.3 | Help Desk | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 266 | 4.1.3.2 | Help Desk - Program Year 1 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 267 | 4.1.3.3 | Help Desk - Program Year 1 | Mon 10/3/11 | Thu 9/27/12 | | | | | | | |
| 268 | 4.1.3.4 | Help Desk - Program Year 1 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 269 | 4.2 | Computing Operations | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 270 | 4.2.2 | Computer Operations - Program Year 2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 271 | 4.2.3 | Computer Operations - Program Year 3 | Mon 10/3/11 | Thu 9/27/12 | | | | | | | |
| 272 | 4.2.4 | Computer Operations - Program Year 4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 273 | 4.3 | Advanced User Support | Fri 10/1/10 | Fri 9/26/14 | | | | | | | |
| 274 | 4.3.1 | Instantiating virtual clusters | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 275 | 4.3.2 | Configuring direct hardware requests | Fri 10/1/10 | Fri 9/26/14 | | | | | | | |
| 276 | 4.3.3 | Application installation and optimization (CPU and I/O) through profiling tools | Fri 10/1/10 | Fri 9/26/14 | | | | | | | |
| 277 | 5 | Training, Education, and Outreach | Fri 10/1/10 | Tue 9/30/14 | | | | | | | |
| 278 | 5.1 | Conferences | Mon 11/15/10 | Fri 11/30/12 | | | | | | | |
| 279 | 5.1.2 | SC10 | Mon 11/15/10 | Fri 11/19/10 | | | | | | | |
| 280 | 5.1.3 | SC11 | Mon 10/3/11 | Wed 11/30/11 | | | | | | | |
| 281 | 5.1.4 | SC12 | Mon 10/1/12 | Fri 11/30/12 | | | | | | | |
| 282 | 5.2 | Annual Surveys | Fri 10/1/10 | Tue 9/30/14 | | | | | | | |
| 283 | 5.2.1 | Program Year 1 | Fri 10/1/10 | Fri 12/17/10 | | | | | | | |
| 284 | 5.2.2 | Program Year 2 | Mon 10/3/11 | Fri 9/28/12 | | | | | | | |
| 285 | 5.2.3 | Program Year 3 | Mon 10/1/12 | Wed 9/25/13 | | | | | | | |
| 286 | 5.2.4 | Program Year 4 | Tue 10/1/13 | Tue 9/30/14 | | | | | | | |
| 287 | 5.3 | Coursework | Fri 10/1/10 | Tue 9/30/14 | | | | | | | |
| 288 | 5.3.1 | FutureGrid tutorials | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 289 | 5.3.1.2 | PY2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 290 | 5.3.1.3 | PY3 | Mon 10/3/11 | Thu 9/27/12 | | | | | | | |
| 291 | 5.3.1.4 | PY4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 292 | 5.3.2 | Nimbus tutorials, on-line materials, etc. | Fri 10/1/10 | Tue 9/30/14 | | | | | | | UC |
| 293 | 6.3.3 | Social appliance tutorials, on-line materials, etc. | Fri 10/1/10 | Tue 9/30/14 | | | | | | | UF |
| 294 | 5.3.4 | Pegasus tutorials, on-line materials, etc. | Fri 10/1/10 | Tue 9/30/14 | | | | | | | USC |
| 295 | 5.3.5 | TACC coursework | Mon 10/3/11 | Wed 10/3/12 | | | | | | | |
| 296 | 5.3.5.1 | FutureGrid used in TACC classes | Mon 10/3/11 | Mon 10/3/11 | | | | | | | |
| 297 | 5.3.5.2 | New FutureGrid course at TACC | Wed 10/3/12 | Wed 10/3/12 | | | | | | | |
| 298 | 5.4 | Outreach | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 299 | 5.4.1 | Open Grid Forum, EGEE, and Unicore | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 300 | 5.4.1.2 | Program Year 2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 301 | 5.4.1.3 | Program Year 3 | Mon 10/3/11 | Thu 9/27/12 | | | | | | | |

| ID | WBS | Task Name | Start | Finish | 09 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-----|----------|--|-------------|-------------|----|------|------|------|------|------|------|
| | | | | | H2 | H1 | H2 | H1 | H2 | H1 | H2 |
| 302 | 5.4.1.4 | Program Year 4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 303 | 5.4.2 | Alladin/Grid5K | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 304 | 5.4.2.2 | Program Year 2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 305 | 5.4.2.3 | Program Year 3 | Mon 10/3/11 | Thu 9/27/12 | | | | | | | |
| 306 | 5.4.2.4 | Program Year 4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 307 | 5.4.3 | German D-Grid | Fri 10/1/10 | Thu 9/27/12 | | | | | | | |
| 308 | 5.4.3.2 | Program Year 2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 309 | 5.4.3.3 | Program Year 3 | Mon 10/3/11 | Thu 9/27/12 | | | | | | | |
| 310 | 5.4.4 | Minority Serving Institutions | Fri 10/1/10 | Thu 9/26/13 | | | | | | | |
| 311 | 5.4.4.2 | Program Year 2 | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 312 | 5.4.4.3 | Program Year 3 | Mon 10/3/11 | Thu 9/27/12 | | | | | | | |
| 313 | 5.4.4.4 | Program Year 4 | Mon 10/1/12 | Thu 9/26/13 | | | | | | | |
| 314 | 6 | Project Management | Tue 3/1/11 | Tue 5/1/12 | | | | | | | |
| 315 | 6.1 | Integrated Project Plans | Tue 3/1/11 | Tue 5/1/12 | | | | | | | |
| 316 | 6.1.3 | Integrated project planning for Program Year 3 | Tue 3/1/11 | Fri 4/29/11 | | | | | | | |
| 317 | 6.1.3 | IPP Year 3 completed | Sun 5/1/11 | Sun 5/1/11 | | | | | | | |
| 318 | 6.1.4 | Integrated project planning for Program Year 4 | Fri 3/2/12 | Mon 4/30/12 | | | | | | | |
| 319 | 6.1.4 | IPP Year 4 completed | Tue 5/1/12 | Tue 5/1/12 | | | | | | | |
| 320 | 6.2 | Status Reports | Fri 10/1/10 | Wed 4/2/14 | | | | | | | |
| 321 | 6.2.1 | Quarterly | Mon 1/3/11 | Sun 9/1/13 | | | | | | | |
| 322 | 6.2.1.4 | Q1 Y2 (Oct-Dec 2010) | Mon 1/3/11 | Mon 2/28/11 | | | | | | | |
| 323 | 8.1.2 | Q1 Y2 completed | Tue 3/1/11 | Tue 3/1/11 | | | | | | | |
| 324 | 6.2.1.5 | Q2 Y2 (Jan-Mar 2011) | Fri 4/1/11 | Tue 5/31/11 | | | | | | | |
| 325 | 8.1.4 | Q2 Y2 completed | Wed 6/1/11 | Wed 6/1/11 | | | | | | | |
| 326 | 6.2.1.6 | Q3 Y2 (Apr-Jun 2011) | Fri 7/1/11 | Thu 9/1/11 | | | | | | | |
| 327 | 8.1.6 | Q3 Y2 completed | Thu 9/1/11 | Thu 9/1/11 | | | | | | | |
| 328 | 6.2.1.7 | Q1 Y3 (Oct-Dec 2011) | Tue 1/3/12 | Tue 2/28/12 | | | | | | | |
| 329 | 8.1.8 | Q1 Y3 completed | Thu 3/1/12 | Thu 3/1/12 | | | | | | | |
| 330 | 6.2.1.8 | Q2 Y3 (Jan-Mar 2012) | Mon 4/2/12 | Wed 5/30/12 | | | | | | | |
| 331 | 8.1.10 | Q2 Y3 completed | Fri 6/1/12 | Fri 6/1/12 | | | | | | | |
| 332 | 6.2.1.9 | Q3 Y3 (Apr-Jun 2012) | Mon 7/2/12 | Fri 8/31/12 | | | | | | | |
| 333 | 8.1.12 | Q3 Y3 completed | Sat 9/1/12 | Sat 9/1/12 | | | | | | | |
| 334 | 6.2.1.10 | Q1 Y4 (Oct-Dec 2012) | Thu 1/3/13 | Thu 2/28/13 | | | | | | | |
| 335 | 8.1.14 | Q1 Y4 completed | Fri 3/1/13 | Fri 3/1/13 | | | | | | | |
| 336 | 6.2.1.11 | Q2 Y4 (Jan-Mar 2013) | Tue 4/2/13 | Thu 5/30/13 | | | | | | | |
| 337 | 8.1.16 | Q2 Y4 completed | Sat 6/1/13 | Sat 6/1/13 | | | | | | | |
| 338 | 6.2.1.12 | Q3 Y4 (Apr-Jun 2013) | Tue 7/2/13 | Sun 9/1/13 | | | | | | | |
| 339 | 8.1.18 | Q3 Y4 completed | Sun 9/1/13 | Sun 9/1/13 | | | | | | | |
| 340 | 6.2.2 | Annual | Mon 10/3/11 | Tue 4/1/14 | | | | | | | |
| 341 | 6.2.2.2 | Program Year 2 (October 2010 - Sept 2011) | Mon 10/3/11 | Wed 2/29/12 | | | | | | | |
| 342 | 8.2.2 | PY2 Annual Report completed | Thu 3/1/12 | Thu 3/1/12 | | | | | | | |
| 343 | 6.2.2.3 | Program Year 3 (October 2011 - Sept 2012) | Mon 10/1/12 | Fri 3/1/13 | | | | | | | |
| 344 | 8.2.4 | PY3 Annual Report completed | Fri 3/1/13 | Fri 3/1/13 | | | | | | | |

| ID | WBS | Task Name | Start | Finish | 09 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-----|------------|---|--------------------|--------------------|----|------|------|------|------|------|------|
| | | | | | H2 | H1 | H2 | H1 | H2 | H1 | H2 |
| 345 | 6.2.2.4 | Program Year 4 (October 2012 - Sept 2013) | Tue 10/1/13 | Fri 2/28/14 | | | | | | | |
| 346 | 8.2.6 | PY4 Annual Report completed | Sat 3/1/14 | Sat 3/1/14 | | | | | | | |
| 347 | 6.2.2.5 | "Lessons Learned" report | Mon 2/3/14 | Mon 3/31/14 | | | | | | | |
| 348 | 8.2.8 | "Lessons Learned" report completed | Tue 4/1/14 | Tue 4/1/14 | | | | | | | |
| 349 | 6.3 | Annual NSF Reviews | Tue 2/1/11 | Wed 4/2/14 | | | | | | | |
| 350 | 6.3.1 | Program Year 1 (October 2009 - Sept 2010) | Tue 2/1/11 | Thu 3/31/11 | | | | | | | |
| 351 | 8.3.2 | PY1 Annual Review completed | Fri 4/1/11 | Fri 4/1/11 | | | | | | | |
| 352 | 6.3.2 | Program Year 2 (October 2010 - Sept 2011) | Wed 2/1/12 | Fri 3/30/12 | | | | | | | |
| 353 | 8.3.4 | PY2 Annual Review completed | Sun 4/1/12 | Sun 4/1/12 | | | | | | | |
| 354 | 6.3.3 | Program Year 3 (October 2011 - Sept 2012) | Fri 2/1/13 | Tue 4/2/13 | | | | | | | |
| 355 | 8.3.6 | PY3 Annual Review completed | Mon 4/1/13 | Mon 4/1/13 | | | | | | | |
| 356 | 6.3.4 | Program Year 4 (October 2012 - Sept 2013) | Mon 2/3/14 | Wed 4/2/14 | | | | | | | |
| 357 | 8.3.8 | PY4 Annual Review completed | Tue 4/1/14 | Tue 4/1/14 | | | | | | | |
| 358 | 6.4 | Annual FutureGrid Meeting | Tue 3/1/11 | Tue 4/2/13 | | | | | | | |
| 359 | 6.4.2 | Program Year 2 | Tue 3/1/11 | Thu 3/31/11 | | | | | | | |
| 360 | 8.4.2 | PY2 Annual FutureGrid Meeting completed | Fri 4/1/11 | Fri 4/1/11 | | | | | | | |
| 361 | 6.4.3 | Program Year 3 | Thu 3/1/12 | Sun 4/1/12 | | | | | | | |
| 362 | 8.4.4 | PY3 Annual FutureGrid Meeting completed | Sun 4/1/12 | Sun 4/1/12 | | | | | | | |
| 363 | 6.4.4 | Program Year 4 | Fri 3/1/13 | Tue 4/2/13 | | | | | | | |
| 364 | 8.4.6 | PY4 Annual FutureGrid Meeting completed | Mon 4/1/13 | Mon 4/1/13 | | | | | | | |
| 365 | 6.5 | User Advisory Board | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |
| 366 | 6.5.3 | PY2 UAB | Fri 10/1/10 | Fri 9/30/11 | | | | | | | |

