# Summary of the Second Annual Campus Grids Workshop

## Forward

This report summarizes the action items and highlights from the second annual campus grids workshop. The original Indico agenda is here:

<http://indico.fnal.gov/conferenceDisplay.py?confId=3674>

Compared to the first Campus Grids workshop, this one focused on a specific set of technical topics – building and running a Condor-based campus grid, as well as extending the Campus Grid to an inter-Campus Grid.

The day was divided into two parts:

* Overview of Campus Grids activity at each site.
* Discussion of the technical aspects of collaborating on Condor-based grids.

This document was written from a set of notes taken by Brian Bockelman.

## Site Summary

This workshop was attended by representatives of the following: Wisconsin, Nebraska, Purdue, Clemson, FermiGrid, Michigan, Oklahoma. Below is a summary of the highlights of each site

* **Wisconsin**: In the last year, there were 57 research groups at GLOW with more than 1000 compute hours, and 29 groups with more than 100,000 hours. For groups, there is approximately 1 FTE of dedicated user support staff and it takes 1-2 weeks per group to get them going. GLOW is highly distributed physically (it is composed of many clusters), but fairly centralized in its administration – in fact, this centralization is one of the advantages for departments to participate in GLOW. Security is submit-host-based, with no strong authentication except for OSG jobs. There are about 15 submit hosts, which is large relative to the rest of the sites. User groups are maintained via flat files. Accounting is kept by the negotiator, which provides only “hours per user”. The data management needs were described as modest – Condor file transfers and AFS, combined with users using traditional unix directory structures.
* **Nebraska**. Nebraska’s Condor-based campus grid effort is just starting this year, but it has had a presence in the OSG and local HPC for several years. Nebraska has two application-support staff, which cover both HTC and HPC needs. The Condor-based usage has primarily been through glideinWMS, meaning users always submit to the OSG, even if they are running on one of the three campus clusters. This requires usage of grid certificates for using the campus grid. Derek Weitzel is working on methods to allow a simpler flow of jobs between on-campus clusters (including non-Condor ones) using a combination of flocking and pilot technology. Data management at Nebraska is primarily done through Condor file transfer for output files and SRM, HTTP, or Condor file transfer for input files. Users are managed through an HCC-specific LDAP server that also keeps track of research groups. HCC uses Gratia for usage accounting.
* **Purdue**. Purdue has a long history in building campus grids, and has a very large one called DiaGrid which includes several large Condor installs (Wisconsin and Notre Dame) and several regional universities. There is about 1 FTE for the campus grids effort and 1.5 FTE of user support. Purdue performs a yearly purchase of computing resources into large community clusters using the “condominium model” (about 8,000 cores a year for the last 3 years). Each of these runs PBSPro and Condor; there is a significant Condor presence on the rest of the campus in addition from the non-centralized IT. Security is host-based, meaning a small number of centrally run submit nodes. Most users run “simple” applications on Condor that require little data management. Accounting is performed by site-custom software. One local management push is cost management; they have been “buying out” departmental clusters and exploring the use of Condor for power management.
* **Clemson**. Clemson has one large resource (Palmetto), plus Windows labs. It is a fairly centralized deployment, and uses the “condominium model” for both storage and compute on their large cluster. They additionally have Condor running on all nodes, and it does not count against researcher’s allocations. There’s a larger user support group at Clemson – about 3 people for user engagement and one for assistance with grants. The campus grid user support helps both with command line and point/click web portals. The HPC site at Clemson utilizes the campus LDAP infrastructure for PBS; any person with a campus login can submit jobs.
* **FermiGrid**. FermiGrid evolved from an effort between experiments to collaborate on their computing infrastructure. They base everything heavily on Globus infrastructure, and include Condor and PBS clusters for CDF, D0, CMS, and smaller Fermi experiments. Everything can be accessed via a site-wide gateway that routes jobs to the FNAL clusters. For data distribution, they provide a large site-wide BlueArc install of about 1PB. As several of the resources are used for production purposes, FermiGrid has converted many of its service to high-availability, and has impressive uptime targets. Users utilize the Fermilab KCA for credentials to provide strong authentication. Accounting is handled by Gratia, and they have additional thorough monitoring to measure both occupancy and effective use of the resources site-wide. FermiGrid uses the OSG VO mechanisms for maintaining user groups. Currently, FermiGrid has enough computing resources to provide for its users and often allows opportunistic use from the OSG.
* **Notre Dame**. Notre Dame has a large, well-established research computing center, but has less of a background in the OSG as the other sites which presented. They have a CMS T3 and a professor, Doug Thain, very active in Condor computing. They are members of DiaGrid and in the process of rolling out Condor on all their SGE clusters. Some of their primary challenges at the site include data management, software management, and IT sustainability. They are also interested in seeing how they could use Condor beyond just “single-core” jobs.

## Inter-Campus Campus Grids Summary

This section focuses on the technical progress made for putting together a large inter-campus grid, based on Condor flocking. It will assume the reader has a moderate level of Condor background.

### Configuration and Service Discovery

Security at many sites – and flocking to some extent - is based on the hostnames of the remote submitters and negotiators. The current state-of-the-art is to pass these lists of hostnames about via email, which we believe will break down when more universities join-in.

The most recent version of Condor allows the necessary information to be kept in a collector instead of config files. It was agreed this technology is interesting, but there was a general consensus that distributing a config file on a Purdue webserver would be simpler. Purdue would then be responsible for vetting the list of accepted endpoints, and sites agreed this would be a sufficient chain-of-trust.

In order to help jobs from different campuses “bootstrap” their environment, it was agreed each site should advertise a few common variables in their startd’s ClassAd, including:

* **OSG\_APP**: A shared file system location appropriate for storing software, possible read-only on the majority of worker nodes.
* **OSG\_DATA**: A shared file system location appropriate for storing data files and writable by each node.
* **OSG\_WN\_TMP**: A local temporary directory for the startd.
  + **$IWD should be usable scratch**: All sites agreed that $IWD will be on usable local scratch space.
* **OSG\_SQUID\_LOCATION**: The location of a server for HTTP caching.
* Complete string of kernel, glibc, and output of `uname –a`. No agreement on attribute name what attribute name to use – the claim was future versions of Condor will provide this.

Any of these variables may be UNDEFINED if the entity does not exist; so, none are required, but if they are defined, they should be used appropriately.

There was significant amount of discussion about how to advertise the available software, but no resolution on the best approach (or whether anything was needed). The final agreement was to set aside the prefix “OSG\_” as a namespace for any future common variables (grandfathering in any variables used currently by glideinWMS).

There is no guarantee about preemptions. Campuses will sometimes enforce memory limits and disk limits in addition to preempting or suspending jobs for higher-priority users. It was pointed out that memory limiting is sometimes done by schedd’s; to properly preempt with flocking, it should be done at the startd level.

### Security

Security was the most active discussion of the day, as there is a wide range of security technologies within the campuses, between campuses, and between the campus and the OSG.

There seemed to be general consensus for the flocking project, host-based security is acceptable, provided the submit nodes are centrally run by the universities. Nebraska had some concerns about having to “partition” grid jobs from flocking jobs in order to make sure that grid proxies would only land on strongly-authenticated hosts.

In addition to the host-based technology for the Condor jobs, a few principles were agreed upon:

* **Communication is key**. Each campus’s security team should be aware of what the teams are doing with Condor and Condor flocking. Having efficient channels of communication between campuses is also important in order to quickly diagnose abnormal behavior.
* **Treat all jobs as foreign**. Clemson pointed out there is little difference between remote campus uses and remote users on the same campus. Both are security threats, and both are arbitrary code.
* **Re-use existing grid security social organizations where possible**. Grids like OSG have well-scripted responses and dedicated effort for security. Where possible, we would like to engage the OSG to see if we can re-use existing response mechanisms for incidents at campuses which are a part of OSG, or at least occur on campus resources attached to the OSG. We also would like to investigate reusing the OSG AUP for the inter-campus grids.
* **Balance security versus available effort**. In the end, there’s a small, finite set of resources available to campus grids. We should make sure we reasonably minimize vulnerabilities, but not to the point where it is impossible to otherwise maintain the grid.

### Accounting

Nebraska had two primary concerns with accounting:

1. Measuring the amount of time given to remote sites
2. The amount of time used at remote sites.

There was general agreement this is not something provided by Condor today with flocking, and this should be improved upon if possible. The negotiator will keep simple statistics for (1). Currently, Gratia accounting is based upon information received by the schedd – so (2) can be achieved if the submitters are centrally controlled and well-maintained.

Recent versions of Condor record the ClassAd of the finished execution at the startd; this was done to support the Clemson-developed BOINC probe. Nebraska volunteered to investigate extending this into a generic Condor probe, which would allow both items to be recorded in Gratia. The biggest issue may be coming up with a way to easily and reliably install a Gratia probe on every startd. A combination of schedd and startd accounting appears to satisfy everyone’s needs.

We will revisit the idea of having a joint Gratia repository summarizing the campus grid usage if there is interest in the future. Such a thing first requires the improved Gratia accounting.

### Expansion

There was general consensus the universities present (Clemson, Purdue, Wisconsin, Notre Dame, and Nebraska) should move forward with the plans to create one large inter-campus Condor flock. We also agreed to publish how this can be accomplished at the technical level.

In order to preserve available effort, we will evaluate on a case-by-case basis other campuses who want to join – each participant needs some level of self-sufficiency. However, Purdue is a big advocate of the hub-and-spoke model: each individual large site might work with smaller regional centers that are not necessarily directly connected to the large inter-campus grid.

There is a reluctance to give tightly label the inter-campus grid as a subset of any one organization (for example, Purdue has spent considerable resources on DiaGrid and wants to avoid the perception OSG is trying to take claim for it) or to create a new organization. So, we decided to be a loosely-defined collection of interoperable campuses and let each decide what label to apply based upon local conditions. However, in order to help OSG understand the scope of the campus grids, it was agreed the existing OSG sites would register as having a “campus flocking” service, similar to how OSG CEs advertise a “CE” service.

## Action Items

The following items include both requests for teams (such as Condor) as well as work items that are agreed upon.

### Condor Action Items

* **Ability to selectively send proxies**: There was concern from Nebraska that all user jobs have proxies attached by default, but the heterogeneous nature of flocking means the proxy might be sent to a node secured via a less-secure method (such as host-based security). Nebraska would like to be able to only send the proxies in certain cases (such as startds started by glideinWMS).
* **Auto-detect proxies in the submitter environment**: Currently, the location of the proxy file must be specified in the submit file; the user is often unaware of the file’s location (usually /tmp/x509\_upXXXX). It would be nice if condor\_submit could automatically figure out the location of the file.
* **Packaging of startd\_last in contrib.**: GLOW uses a script named startd\_last, which is a condor\_startd equivalent of the unix command “last”. It would be beneficial tool for debugging, especially with multiple schedd’s submitting to each site’s startd’s.
* **Advertise kernel and glibc versions:** We understand this is planned for future releases; we’d like to know what ClassAd attributes will be used.
* **Advise on developing “collector of collectors”:** The proposed mechanism of periodically downloading configuration files is very simple; it appears Condor is planning to improve this by allowing schedds to flock with all negotiators in a given collector. This may be a cleaner way to communicate this information. We would appreciate feedback on the Condor team’s plans in this area.

### Purdue Action Items

* **Develop and maintain a central configuration**: Purdue volunteered to maintain a configuration listing endpoints and a technology for all participating sites. This will probably be the largest operational task.

### Nebraska Action Items

* **Contribute a Gratia probe for the condor\_startd**: Based on the current needs and capabilities for accounting, it was decided to develop technology to get additional information from the condor\_startd into Gratia.
* **Continue development on the campus factory**.

### Clemson Action Items

* **Test out the campus factory**. The campus grid factory would allow Clemson to only run Condor daemons on its cluster on-demand and within PBS, simplifying their local deployment.

### OSG Campus Grids Action Items

* **Coordinate**. OSG Campus Grids provides a forum for each site to meet and communicate on a regular basis.
* **Publish documentation and agreements**. Publish technical documentation on the agreed-upon
* **Work with OSG Security**. Come to agreement on what OSG Security processes can be reused (i.e., AUPs and maybe ticketing), and where the limits of OSG security effort are.
  + There is a need for a short paper outlining the plan for security.