
Usable Distributed Cyberinfrastructure: Campus Grids, OSG Connect & User Support



slides online: <http://bit.ly/1uM3qEz>

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OPENSOURCEGRID.ORG • CAMPUSGRIDS.ORG • OSGCONNECT.NET



Open Science Grid

Campus grids mission



- Create an open forum for broad discussions of DHTC practices (users & campus research computing center professionals)
 - → Campus Infrastructures Community
- Provide an easy on-ramp to OSG for campus researchers → OSG Connect
- Deliver campus grids as a service

Campus Infrastructures Community



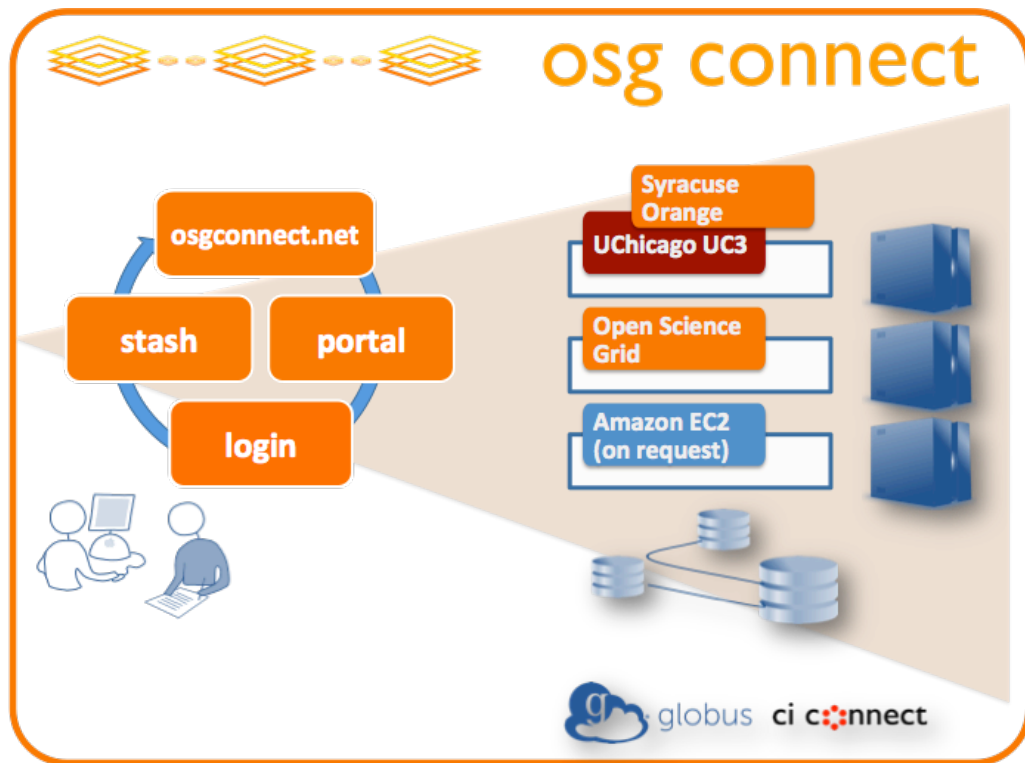
CIC: Workshops, webinars, archive of demos

The screenshot shows the homepage of www.campusgrids.org. At the top, there is a navigation bar with the OSGCAMPUSINFRASTRUCTURES logo and the tagline 'COMMUNITY OF THE OPEN SCIENCE GRID'. Below the logo, there are social media icons for Facebook, Twitter, and Google+. The main content area features a large graphic with the text 'osg connect' and a 'Get started here' button. To the left of this graphic, there is a sidebar with the text 'OSGCIC' and 'thinking LOCALLY computing GLOBALLY'. Below this, it states 'The OSG CIC is open to all computing organizations interested in advancing high throughput capability on their campus, and bridging campus resources to the national cyber ecosystem for the benefit of science.' There are also icons for 'campus', 'grid', and 'cloud', and a section titled 'ACCELERATING SCIENTIFIC COMPUTING'.

The screenshot shows a webcast titled 'OSG Campus Infrastructures Community Webcast - ...'. The main content is a slide titled 'Data Flow for Program Workflows on OSG with GlobusWMS and Staging Storage Element'. The slide contains a complex diagram showing data flow between various components, including 'Data Flow for Program Workflows on OSG with GlobusWMS and Staging Storage Element', 'OSG Connect', and 'Staging Storage Element'. A large play button is overlaid on the slide. In the top right corner, there is a video feed of a person speaking. Below the video feed, there is a list of participants and a chat window.

campusgrids.org

OSG Connect for users



Make OSG seem like a virtual campus cluster:

- login
- software
- job scheduling
- job data

OSG Connect approach



- Leverage existing work, don't develop
 - OSG VO & GlideinWMS overlay services for resource access; OASIS, Modules for software access; Gratia accounting & OIM information service
 - Globus (ID & transfer), CI-Logon
 - HTCondor (& Bosco-as-service) for other clusters
- Deliver as service
 - Leverage automated build & configuration practices from LHC Tier 2 Centers



OSG Connect service elements



- Identity & group management service
- Auto account provisioning to login host
- Flocking services
- Data service (for quasi-transient job data)
- Job monitoring, accounting service
- User facing monitoring & documentation
- Continuous validation services

Identity and group management



- Leverage the Nexus service from Globus
- Use home campus identity with CI-Logon & InCommon federation services
- Users authorized in standard way but without grid certificate and VO service overhead
- Associate users with Groups (OSG Projects) for accounting and to control access

Auto provisioning of user accounts



- The service periodically checks for newly authorized members
- Creates Unix account, and users can quickly login and start work (no admin needed)
- Goal is to have users running jobs on OSG within the hour

Acceptable Use Policy

By registering with OSG Connect as a GRID user you shall be deemed to accept these conditions of use:

1. You shall only use the GRID to perform work, or transmit or store data consistent with the stated goals and policies of the VO of which you are a member and in compliance with these conditions of use.
2. You agree that any publications resulting from the computation performed on OSG will include the following citation:

This research was done using resources provided by the Open Science Grid, which is supported by the National Science Foundation and the U.S. Department of Energy's Office of Science."

Additional information is available at <http://osgconnect.net/citations> — see also <https://twiki.opensciencegrid.org/bin/view/Management/ScientificPublications>.

3. You shall not use the GRID for any unlawful purpose and not (attempt to) breach or circumvent any GRID administrative or security controls. You shall respect copyright and confidentiality agreements and protect your GRID credentials (e.g. private keys, passwords), sensitive data and files.
4. You shall immediately report any known or suspected security breach or misuse of the GRID or GRID credentials to the incident reporting locations

I Accept

Sign up for OSG Connect

You can sign up for OSG Connect in a few basic steps:

1. Visit the [OSG Connect sign-in portal](#) (this will open in a new tab or window).
2. Click **Proceed** to authenticate with your campus NetID. Your browser will redirect you to a [cilogon.org](#) site.
 - In the **Select an Identity Provider** area, find OSG Connect and select it.
 - Check the **remember this selection** box, then click **Log On**. Your browser will redirect you to the OSG Connect authentication page. It should look familiar to you. *If you have recently signed in, you may not need to re-authenticate.*
 - Sign in as you normally would, using your campus NetID and password. Your browser will take you briefly past [cilogon.org](#) again, before returning you to the sign-in portal. *These steps allow you to sign in to the web portal any time using your OSG Connect credentials.*
3. Now you will see a page entitled **Need to Make a Connection**. This links your campus NetID to an OSG Connect account. If you already own a Globus account, that will also be your OSG Connect account: sign in with your Globus credentials here, then move ahead to step 5.
4. Otherwise, click **Create a new Globus account**.
 - Enter your full name and your OSG Connect email address. It's important to use your OSG Connect address so that OSG Connect administrators can approve your access.
 - Enter a username and password to use for your OSG Connect account. The site will interactively let you know if your chosen name is unavailable.
 - You must indicate your acceptance of the Globus terms of service by checking the appropriate box. (Other boxes are optional.)
 - Click **Register** to create your account. You will need to validate your email address before proceeding:
 - Wait for an email from support@gllobus.org containing your validation URL.
 - Click the link, or paste it into your browser where you are.
 - Your account will be confirmed.
5. To complete sign-up, you will join the **osg** group. This is automated, but requires some additional information:
 - your **first name**
 - your **last name**
 - your **field of science**
 - your **organization** (university, institution, agency, etc)
 - your **department** within that organization

This information is used for resource utilization reports, to build longitudinal analyses of how grid resources are used.
6. After a moment, you will have joined the **osg** group, and your browser will bounce over to the **Manage Identities** screen. It is advisable that you **add an SSH public key** now, but it is not required — you may do this at any time. The SSH key will grant you passwordless access to the OSG Connect login server. [login.osgconnect.net](#). If you do not know how to generate an SSH key, you may find our [SSH Key Generator](#) helpful.

Signing up

My Groups
Search

- ▶ INVITATIONS (MEW & RESPOND)
- ▼ MEMBERSHIP APPROVAL PENDING
 - University of Chicago Research Computing Center
- ▶ MANAGER OF
- ▼ MEMBER OF
 - atlas.org.uchicago
 - atlas.wg.Exotics
 - atlas.wg.Higgs
 - atlas.wg.SUSY
 - connect
 - duke
 - duke.4fermion
 - duke.campus
 - osg
 - osg.ConnectTrain
 - osg.OSG-Staff
 - umich

Create New Group > ● admin action required

OSG
Home
Members
Subgroups

Managers are listed in bold.

<p>CI Connect</p> <p>OSG Connect Operations</p> <p>Aaron Gerow</p> <p>Alain Deximo</p> <p>Alan Sill</p> <p>Alden Stradling</p> <p>Amanda Lund</p> <p>Amanda Whitlock</p> <p>Amin Nikahtar</p> <p>Amit Kumar</p> <p>Andre Luckow</p> <p>Andre Merzky</p> <p>Andrea Manzi</p> <p>Anna Elizabeth Woodard</p> <p>Anna Olson</p> <p>Annika Eriksson</p> <p>Anoop Mayampurath</p> <p>Anton Betten</p> <p>Anton Yu</p> <p>Balamunagan Desinghu</p> <p>Ben Eisenbraun</p> <p>Benjamin Brachi</p> <p>Bing Xie</p> <p>Bo Rodda</p> <p>Bockjoo Kim</p> <p>Brendan Albano</p> <p>Brennan Govreau</p> <p>Brian Mitchell</p> <p>Brij Kishor Jashai</p> <p>Brooklin Gore</p> <p>Bryan Howell</p> <p>Cesar Pollack</p> <p>Chaoren Liu</p> <p>Chaowen GUO</p> <p>Chen Li</p> <p>Chetan Raj Ruppakheti</p> <p>Choa-In Chou</p> <p>Christian Ross</p>	<p>Garhan Attebury</p> <p>Gerard Bernabeu Altayo</p> <p>Giovanni G. Baez Flores</p> <p>Glen Hocky</p> <p>Gonzalo Merino</p> <p>Harinder Singh Bawa</p> <p>Ian Foster</p> <p>Igor Stiglizi</p> <p>Igor Stiglizi</p> <p>Ilija Vukotic</p> <p>JUAN DIEGO HERNANDEZ J...</p> <p>Jacob Roberts</p> <p>James Christopher Westland</p> <p>James Zhang</p> <p>Jan Balewski</p> <p>Janina Krumbek</p> <p>Jay Fowler</p> <p>Jeff Dandoy</p> <p>Jerry Perez</p> <p>Jimmy Dorff</p> <p>Joakim Olsson</p> <p>John Blischak</p> <p>John wang</p> <p>Jonah Bernhard</p> <p>Jonathan Schroeder</p> <p>Jordan Govreau</p> <p>Jose Ramón Alvarez de los ...</p> <p>Joseph Haley</p> <p>Joseph Kleinhenz</p> <p>Julian Veise</p> <p>Karan Vahi</p> <p>Kari Jabonowski</p> <p>Karthikeyan Saravanan</p> <p>Kenichi Hatakeyama</p> <p>Kenneth Aird</p> <p>Kenneth Bloom</p> <p>Ketan Maheshwari</p> <p>Kevin Hill</p>	<p>OSG Training 1</p> <p>OSG Training 2</p> <p>OSG Training 3</p> <p>OSG Training 4</p> <p>OSG Training 5</p> <p>OSG test</p> <p>Ole Weidner</p> <p>Patrick A Reeves</p> <p>Patrick Maisom</p> <p>Paul Alexander</p> <p>Peter F Couvares</p> <p>Peter Hadlaw</p> <p>Philip W. Smith</p> <p>Philippe Grassia</p> <p>Po-He Tseng</p> <p>Rachana Ananthakrishnan</p> <p>Rachel Killackey</p> <p>Rafael Francisco Pagan Vargas</p> <p>Raffaella Montella</p> <p>Rick Irving</p> <p>Rob Gardner</p> <p>Rob Quick</p> <p>Robert Cowles</p> <p>Robert Hippe</p> <p>Rohan Jatpal</p> <p>Rupa Sravani Kommineni</p> <p>Ruth Marinshaw</p> <p>Saad Nasser</p> <p>Samuel Meehan</p> <p>Samuel van Loon</p> <p>Scott Shi</p> <p>Scott Teige</p> <p>Shantenu Jha</p> <p>Shi-Jian Ding</p> <p>Shijie Li</p> <p>Simon Jacobs</p> <p>Soichi Hayashi</p> <p>Soon Kat Lau</p>
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Groups and users

connect
osg

- osg.AMFORA
- osg.AIGDock
- osg.BioMolMach
- osg.BioStat
- osg.CompChem
- osg.CompNeuro
- osg.ConnectTrain
- osg.ConnectTrain
- osg.ContinuousIntegration
- osg.DBConcepts
- osg.Duke-QGP
- osg.Errorstudy
- osg.EvoTheory
- osg.ExhaustiveSearch
- osg.FFValidate
- osg.GRASP
- osg.GlassySystems
- osg.HTCC
- osg.HealthInformatics
- osg.IceCube
- osg.KnowledgeLab
- osg.KnowledgeSys
- osg.NESCent
- osg.NREL-MatDB
- osg.OSG-Staff
- osg.OSGOpsTrain
- osg.Orbiter
- osg.PathSpaceHMC
- osg.PhysStat
- osg.PlantBio
- osg.ProtFolding
- osg.Proteomics
- osg.RADICAL
- osg.RDCEP
- osg.SBGrid
- osg.SNOplus
- osg.SouthPoleTelescope
- osg.StanfordRCC
- osg.Swift
- osg.UChicago-RCC
- osg.UserSchool2014
- osg.aprime

OSG projects

Job service: keeping it simple



- Not a gateway or web portal
 - Users must be shell-literate
- Resource targets advertise attributes back to the Condor schedd as usual
- Usual ClassAds and Condor submit scripts
 - Users are responsible for anything more in terms of workflow tools
- Recipes, templates for the “DHTC way”

Resource targets



- OSG GlideinWMS is the workhorse
- UChicago campus grid (UC3)
- In progress:
 - Syracuse University HTCondor pool (OrangeGrid)
 - St. Louis University SGE compute pool
- Any cluster running Condor, PBS, SLURM, or SGE can be directly added to OSG Connect (using Bosco) requiring only a user account on the resource
- Optionally can add Amazon EC2 instances (e.g. workshops, bootcamps, etc, for guaranteed execution)

Storage service: Stash



- Provide a quasi-transient storage service for job input/output data
- Implemented with Ceph object store
- POSIX access provided to the login host
- Globus Online Server for managed transfers from campus data services
- Personalized http service endpoint

https://portal.osgconnect.net/xfer/ViewActivity

osg connect

Activity

Sort By start date & time filter this list

atlasconnect#faxbox to connect#stash
transfer completed 4 minutes ago

overview event log

Task ID	a2dd8724-228a-11e4-b5be-12313940394d
Source	atlasconnect#faxbox
Destination	connect#stash
Status	SUCCEEDED
User	rwg
Requested	2014-08-12 08:39 pm
Deadline	2014-08-13 08:39 pm
Completed	2014-08-12 08:43 pm
Transfer Settings	<ul style="list-style-type: none"> overwriting all files on destination verify file integrity after transfer transfer is not encrypted

Files	6
Directories	1
Bytes Transferred	7,838,465,334
Pending	0
Succeeded	8
Cancelled	0
Expired	0
Failed	0
Retrying	0
Skipped	0

view debug data

- rwg#laptop to connect#stash
transfer completed a month ago
- rwg#laptop to connect#stash
transfer completed a month ago
- rwg#laptop to osgconnect#stash
transfer completed 4 months ago
- rwg#laptop to connect#faxbox
transfer completed 6 months ago
- rwg#laptop to connect#faxbox
transfer completed 6 months ago

Easy, reliable upload of data to Stash for processing on OSG, and downloading output data back to campus.

Here we leverage Globus transfer



https://portal.osgconnect.net/xfer/ManageEndpoints

osg connect

Manage Endpoints

add Globus Connect Personal add an endpoint

recently used in use shared with me shared by me administered by me all filter list by endpoint name

endpoint	status	credential
atlasconnect#faxbox	in use	never expires
connect#faxbox	ready	never expires
connect#stash	in use	never expires
osgconnect#stash	ready	never expires
rwg#laptop Globus Connect Personal	ready	never expires

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Application software



- Legacy DHTC methods for software access:
 - HTCondor file transfer + http access
- OSG OASIS+Modules

```
$ module avail
$ module load R
$ module load namd
$ module purge
```

```
rwg — rwg@login01:~ — ssh
[rwg@login01 ~]$ module avail

----- /cvmfs/oasis.opensciencegrid.org/osg/modules/modulefiles/Core -----
R/3.1.1                fftw/3.3.4-gromacs      lapack                 python/3.4
SitePackage           fftw/3.3.4              (D)                   lmod/5.6.2           ghull/2012.1
SparseSuite/4.2.1     gcc/4.6.2              matlab                settarg/5.6.2
atlas                 glpk/4.54              namd/2.9              wget/1.15
blast                gromacs/4.6.5          octave/3.8.1
blender              hdf5/1.8.13            pcre/8.35
curl/7.37.1          jpeg                   python/2.7 (D)

Where:
(D):  Default Module

Use "module spider" to find all possible modules.
Use "module keyword key1 key2 ..." to search for all possible modules matching any of the "keys".

[rwg@login01 ~]$
```

- Common OSG user collections
- Curating based on user demand
- Will include XSEDE rpms
- Tracking by user, project & site for analytics

User-facing OSG usage & data



https://osgconnect.net

osg connect

Welcome back, Robert

Personal Grid Metrics

Move to front Unhide Reset all

User Jobs (48h)						
User	Project	Project Total	Jobs	Hours	Cost	Size
Rob Gardner	scicomp-analytics	Project Total	3670	311.01	0.00	0.00
	Tusker		874	73.50	0.00	0.00
	UCSDT2		193	16.61	0.00	0.00
	FLTECH		28	2.39	0.00	0.00

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Powered by:

Storage used by me, by my projects

stash.osgconnect.net/+rwg/

osg connect

Search:

Type	Name	Kind	Changed	Size
>	temp	directory	Thu, 17 Jul 2014 12:51	0 items
	RegistrantsList (1).xls	application/vnd.ms-excel	Mon, 26 Aug 2013 21:01	31.00 k
	chart_pie_30805.html	text/html	Tue, 24 Sep 2013 11:40	5220
	chart_pie_5000.html	text/html	Tue, 24 Sep 2013 11:41	1297
	user.kkrizka.012421_01284.output.root	application/octet-stream	Tue, 24 Sep 2013 14:20	970.00 m

Showing 1 to 5 of 5 entries

← Cycles used by me, my projects, and by others

Job Table

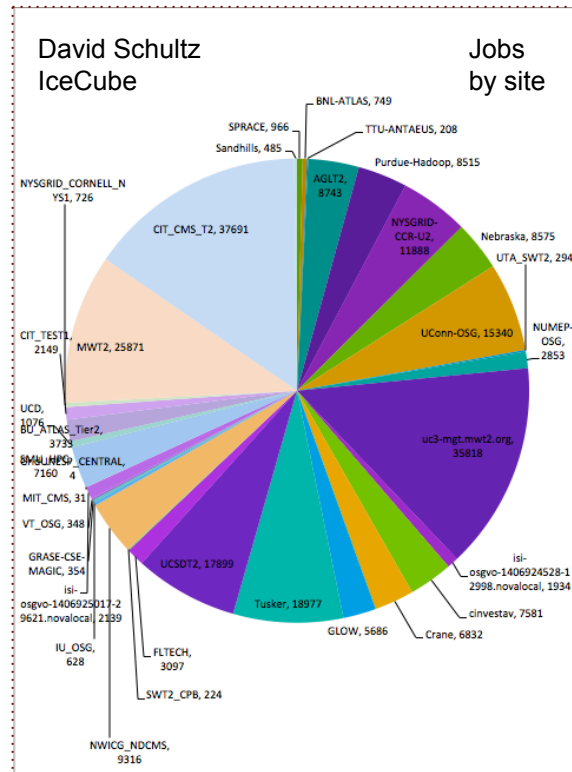
User	Project	Site	Number of Jobs ▲	Wall Time (hours)	CPU Time (hours)	CPU Efficiency (%)
David Schultz	IceCube	Project Total	247956	50458.79	27605.83	37.78
		CIT_CMS_T2	37699	7323.69	4245.65	57.97
		uc3-mgt.mwt2.org	35850	10080.07	6802.68	67.49
		MWT2	25871	8413.21	5568.44	66.19
		Tusker	18977	2679.87	1381.09	51.54
		UCSDT2	17899	2675.77	1295.81	48.43
		UConn-OSG	15346	1869.64	1013.89	54.23
		NYSGRID-CCR-U2	11892	3629.85	1908.63	52.58
		NWICG_NDCMS	9316	1282.32	59.50	4.64
		AGLT2	8743	2520.62	1798.46	71.35
		Nebraska	8575	1800.42	1161.09	64.49
		Purdue-Hadoop	8515	1170.20	262.08	22.40
		cinvestav	7585	1265.95	0.00	0.00
		SMU_HPC	7160	781.22	11.34	1.45
		Crane	6832	418.38	87.66	20.95
		GLOW	5686	755.31	477.31	63.19
		BU_ATLAS_Tier2	3735	1126.05	654.30	58.11
		FLTECH	3106	359.10	31.09	8.66
		NUMEP-OSG	2853	147.27	56.85	38.60
		CIT_TEST1	2149	100.28	15.50	15.46
		isi-osgvo-1406925017-29621.novalocal	2139	290.97	0.00	0.00
		isi-osgvo-1406924528-12998.novalocal	1934	198.29	0.00	0.00
		UCD	1076	305.09	129.79	42.54
		SPRACE	966	350.93	209.78	59.78
		BNL-ATLAS	750	215.72	125.86	58.35
		NYSGRID_CORNELL_NYS1	726	109.36	68.00	62.18
		IU_OSG	628	193.03	117.13	60.68
		Sandhills	485	59.10	35.86	60.67
		GRASE-CSE-MAGIC	354	108.11	8.60	7.96
		VT_OSG	348	87.40	6.84	7.83
		UTA SWT2	294	57.42	30.90	53.82

<http://bit.ly/1sPlxrX>

By user, project, site, #jobs, wall time, cpu time, cpu efficiency

Tailored to user: can optionally see where jobs run and how efficiently. More job info planned (success/failures, by task, etc.)

Job Monitoring

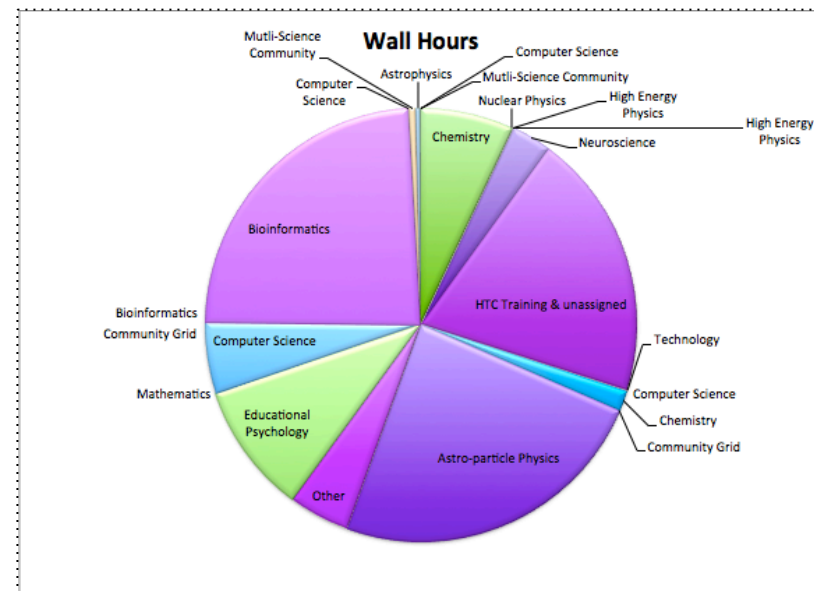


OSG Connect usage in 2014

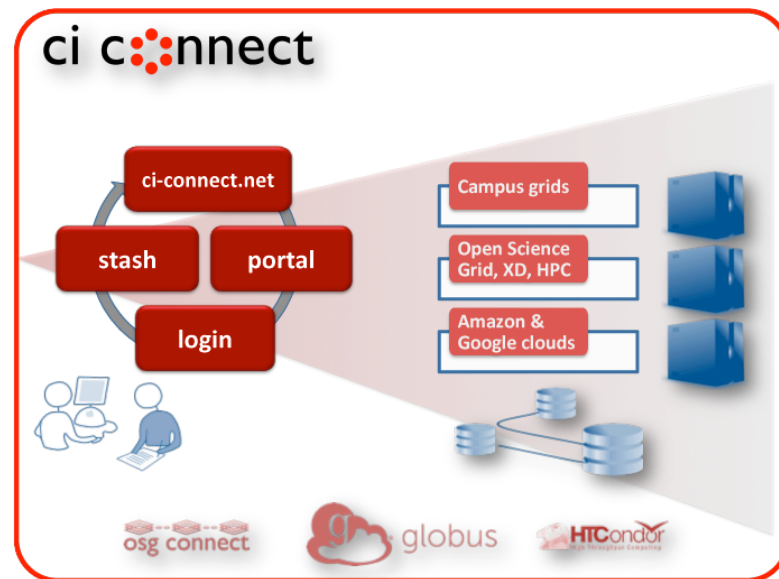
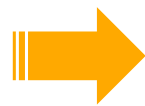
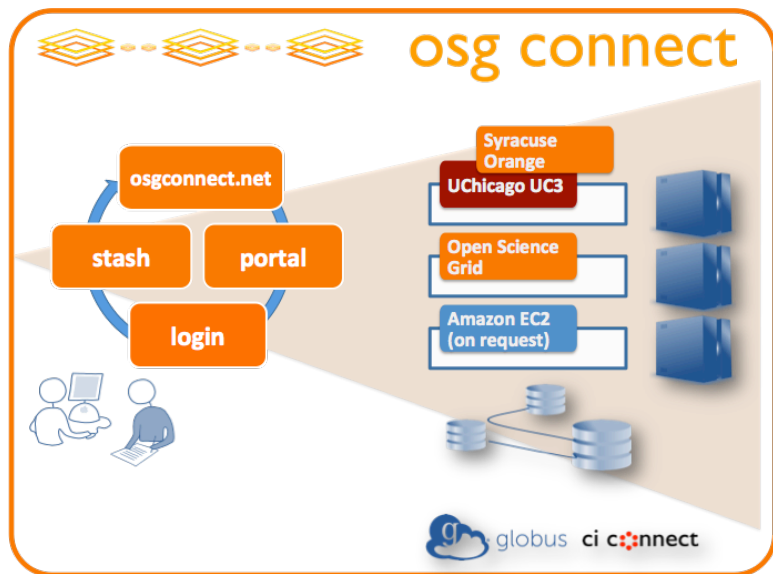


OSG-Connect Projects 2014/01/01 - 2014/08/12

Project Name	PI	Institution	Field of Science	Wall Hours
AIGDock	David Minh	Illinois Institute of Technology	Chemistry	154,236
aprime	Jan Balewski	MIT	Nuclear Physics	348
atlas-org-uchicago	Robert Gardner	University of Chicago	High Energy Physics	1,165
AtlasConnect	Robert Gardner	University of Chicago	High Energy Physics	768
CompNeuro	Po-He Tseng	Duke University	Neuroscience	67,048
ConnectTrain	Robert Gardner	University of Chicago	HTC Training	441,422
ContinuousIntegration	Robert Gardner	University of Chicago	Technology	1,503
DBConcepts	Richard Jean So	University of Chicago	Computer Science	26
FFValidate	Vijay Pande	Stanford University	Chemistry	34,035
HTCC	Robert Quick	Indiana University	Community Grid	142
IceCube	Francis Halzen	University of Wisconsin	Astro-particle Physics	534,653
KnowledgeLab	James Evans	University of Chicago	Other	100,537
KnowledgeSys	Michael J. Culbertson	University of Illinois, Urbana-Champaign	Educational Psychology	218,451
Orbiter	Anton Betten	Colorado State University	Mathematics	50
OSG-Staff	Chander Sehgal	Fermilab	Computer Science	117,543
OSGOpsTrain	Robert Quick	Open Science Grid	Community Grid	43
Proteomics	Sam Volchenboun	University of Chicago	Bioinformatics	320
ProtFolding	Jinbo Xu	Toyota Technological Institute at Chicago	Bioinformatics	531,865
RADICAL	Shantenu Jha	Rutgers University	Computer Science	11
scicomp-analytics	Robert Gardner	University of Chicago	Muti-Science Community	11,574
SouthPoleTelescope	John Carlstrom	University of Chicago	Astrophysics	7,507
Swift	Michael Wilde	University of Chicago	Computer Science	280
UserSchool2014	Tim Cartwright	OSG	Muti-Science Community	739
Total				2,224,264

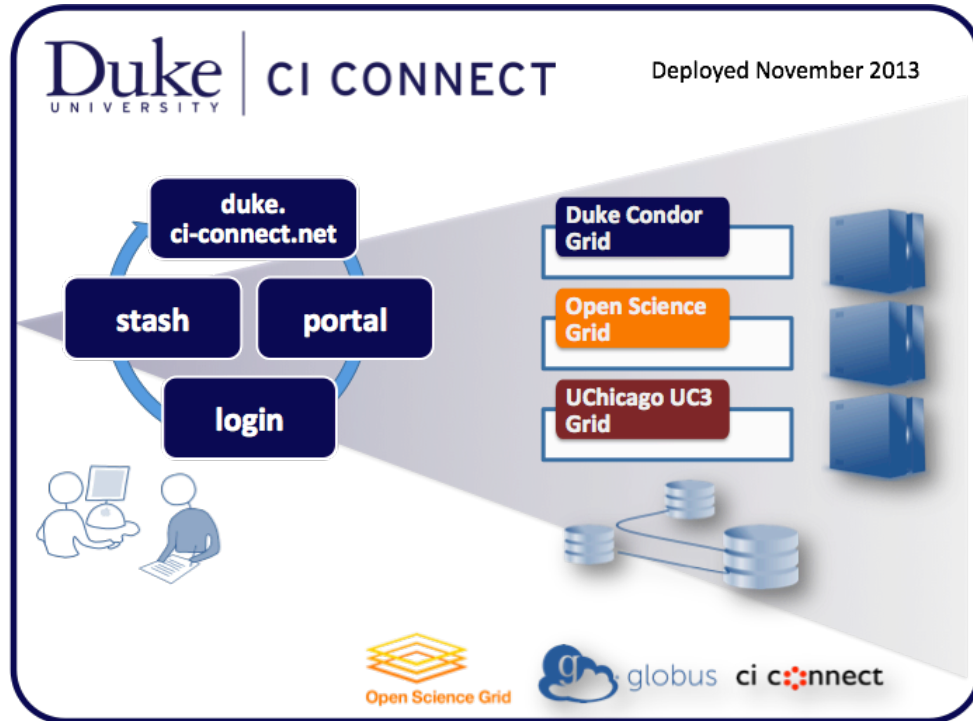


Campus grids as service



A generic pattern for connecting campuses to national cyber infrastructure

Duke CI Connect: 1st campus grid as service

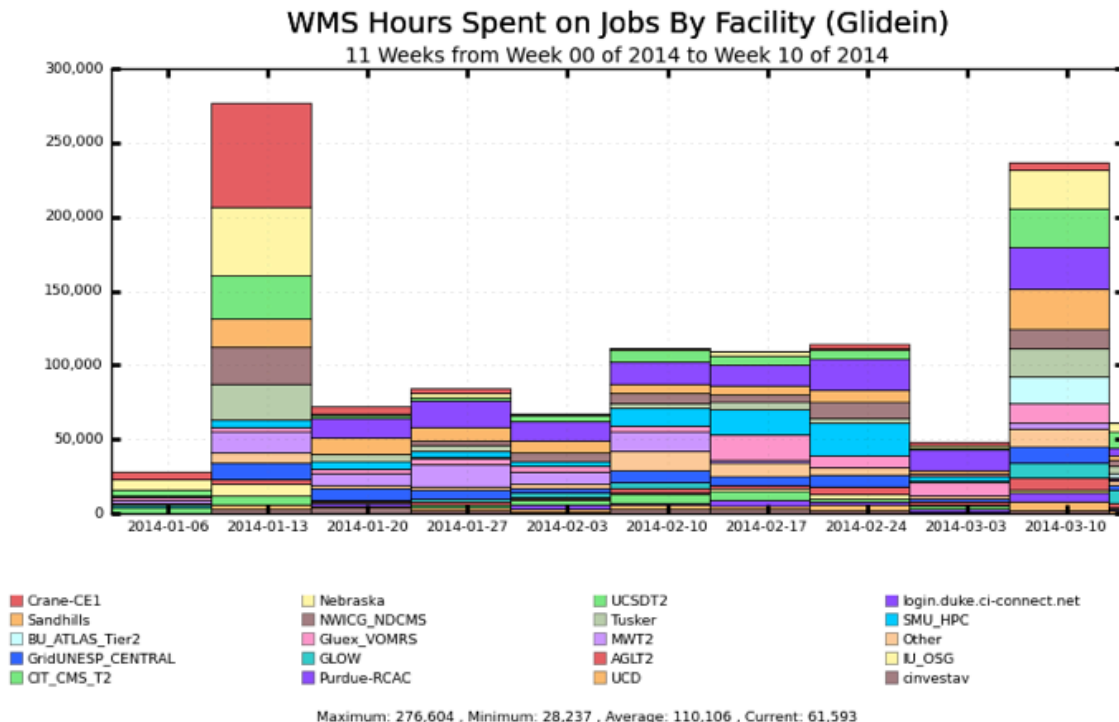


Minimize entry barrier for campus grids & bridging

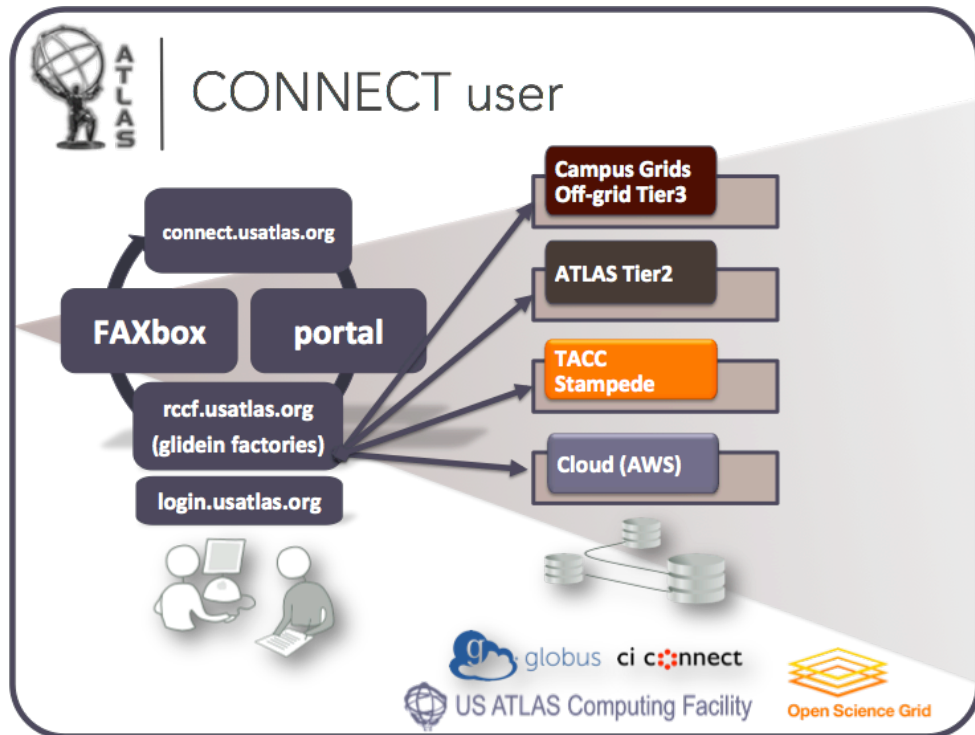
Users submit locally as before, but can overflow to OSG or other targets

No local IT building: just a standard login account to get started

Duke Campus → OSG Open Facility



CI Connect for communities



Virtual LHC Tier-3 service for analysis batch processing

Flexible mix of resource targets, including “off-grid” Tier-3s and campus clusters

Lessons for software access on non-OSG, non-LHC resources (e.g. XSEDE)

Campus grids in progress



- Expect these to be in production very soon

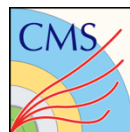


THE UNIVERSITY OF
CHICAGO

Research
Computing
Center



CONNECT
UNIVERSITY OF MICHIGAN



connect

Each presents specific challenges that provide lessons for new campuses.

Service upgrades provided centrally, no local updates, re-installs, etc.

Revisiting submit client as **module** (rpm installed by local admin) for home cluster → connect service → OSG + CI submit mode { `$module load connect` }

Back to Syracuse OrangeGrid



- HTCondor campus grid:
 - ~3000 desktops with virtual machines running in the background supporting SL6 and Ubuntu
 - Condor Virtual Machine Coordinator interfaces with HTCondor to launch and manage virtual machines. Grown from 6000 to 10000+ cores.
- First Phase:
 - OrangeGrid as an OSG Connect resource target
- Second phase:
 - CI Connect instance, virtually extending OrangeGrid to the OSG for Syracuse researchers

User support & engagement



- CIC workshops
- OSG Connect → OSG User School
- With User Support, developing joint boot camp with Software Carpentry for the fall



Strategy will be to partner with campus HPC / computing center consultants

revision control
in github

ConnectBook
Home
Created by Rob Gardner, last modified by Suchandra Thapa on Jul 09, 2014

user
recipes

osg connectbook

ConnectBook on Github

- All of the examples here are available on github.com/OSGConnect
- The OSG login host (login.osgconnect.net) has most examples pre-installed; to see whats available:
 - \$ tutorial

Distributed High Throughput Fundamentals

- Properties of High Throughput Computing Applications

Getting Started on OSG Connect

- Registration and login instructions (or go directly to the site)
- QuickStart job submission tutorial
- Job submission to OSG Connect from a laptop
- Start a Project with OSG Connect
- Best practices for running jobs
- Troubleshooting job failures

More Application

- Using GNU Octave
- Using CERN ROOT
- Using BLAST (gen

Higher Level Tool

- Using Bosco integ
- Using Pegasus to
- Using Swift (a par

Connecting Your

- Submit to your ca

Getting Help and

- The OSG Connect

S	W	Name ↓	Last Success	Last Failure	Last Duration
●	☀	OSIS	1 hr 11 min - #324	3 days 11 hr - #283	1 sec
●	☀	OSG_Connect_HTCondor_transfer	37 min - #341	18 days - #121	51 sec
●	☀	OSG_Connect_Oasis_Parrot	4 hr 23 min - #190	3 days 20 hr - #173	23 min
●	☀	OSG_Connect_Octave	57 min - #194	1 mo 6 days - #26	4 min 9 sec
●	☀	OSG_Connect_Pegasus	1 hr 1 min - #216	21 hr - #211	18 min
●	☀	OSG_Connect_Photodemo	1 hr 9 min - #187	1 mo 6 days - #17	12 min
●	☀	OSG_Connect_Quickstart	39 min - #220	1 mo 6 days - #51	3 min 18 sec
●	☀	OSG_Connect_R	1 hr 4 min - #192	8 days 9 hr - #141	7 min 15 sec
●	☀	OSG_Connect_Root	44 min - #244	6 days 8 hr - #205	1 min 54 sec
●	☀	OSG_Connect_Scaling	45 min - #189	1 mo 6 days - #20	1 min 47 sec
●	☀	OSG_Connect_Software	52 min - #186	3 days 18 hr - #162	51 sec
●	☀	OSG_Connect_Stash_HTTP	45 min - #197	3 days 18 hr - #173	33 sec
●	☀	OSG_Connect_Swift	30 min - #242	3 days 18 hr - #218	4 min 52 sec
●	☀	Stash_Globus	26 min - #321	26 days - #6	9.7 sec
●	☀	Stash_HTTP	1 hr 8 min - #347	25 days - #46	0.64 sec
●	☀	Stash_POSIX	42 min - #316	18 days - #97	0.65 sec

Continuous unit
testing with
Jenkins

Summary and Conclusions



- Campus Grids and OSG Connect are effectively incorporating core OSG principles
 - shared access, overlays, trust model, openness,...
- Will evolve methods to integrate campus infrastructures for the benefit of small research groups and campus IT providers
 - Providing them as value-added services for campus IT means multiple instances benefit from innovation