

# Introduction to the Open Science Grid

OSG Software Carpentry Workshop

Duke University

Oct 29<sup>th</sup>, 2015

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OSG User Support

# Outline

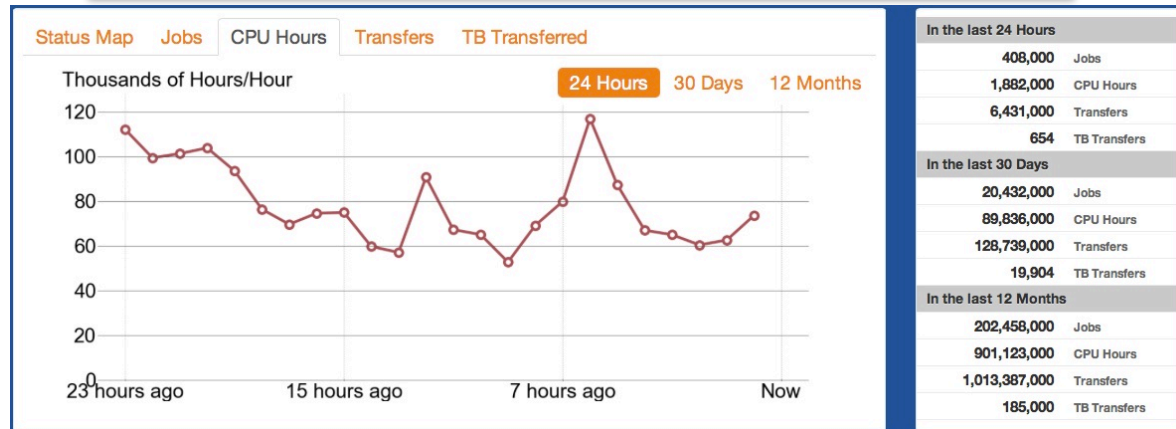
- What is the OSG?
- Virtual Organizations
- Jobs that are good for OSG/DHTC
- OSG Entry Paths (Duke Ci-Connect)
- Job Submission
- User Tools

# The Open Science Grid

A **framework** for large scale distributed resource sharing addressing the technology, policy, and social requirements of sharing computing resources.

OSG is a **consortium** of software, service and resource providers and researchers, from universities, national laboratories and computing centers across the U.S., who together build and operate the OSG project. The project is funded by the NSF and DOE, and provides staff for managing various aspects of the OSG.

- >50 research communities
- >120 sites
- >100,000 cores accessible



# Virtual Organizations

- The OSG environment is VO based.
  - Resource usage accounting
  - VOs can be science communities (e.g. ATLAS, CMS) or
  - Multi-disciplinary Campus based [e.g. U-Nebraska(HCC), U-Wisconsin(GLOW)]
- Each OSG user is a member of a VO
- Users can be members of multiple VOs
- Site resources are owned by one or more VOs.

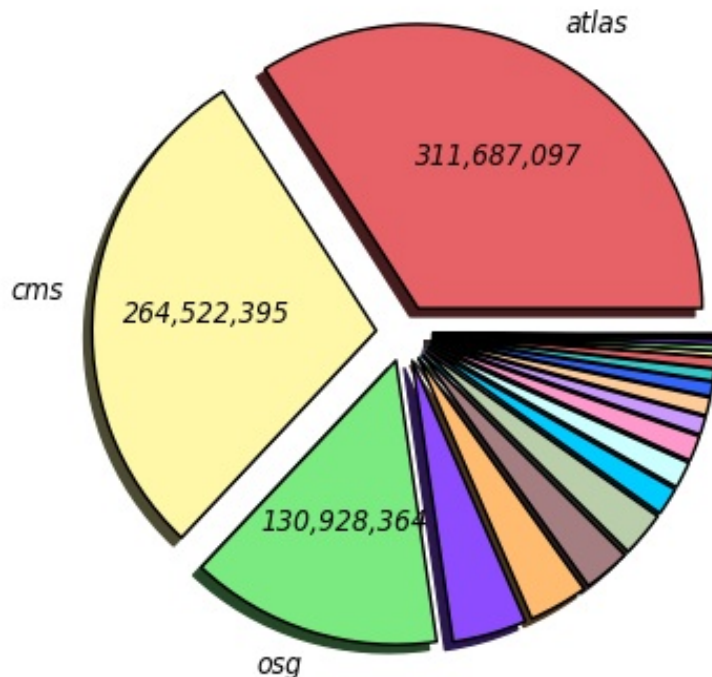
# Virtual Organizations

- The **OSG VO** provides access to US researchers who are *not already affiliated* with an existing community in OSG.
- OSG VO is “Opportunistic” VO: users take advantage of unused cycles on resources owned by others.
- Opportunistic VOs: OSG, GLOW, Engage, HCC, SBGrid, Gluex

# OSG Usage

Wall Hours by VO (Sum: 914,870,509 Hours)

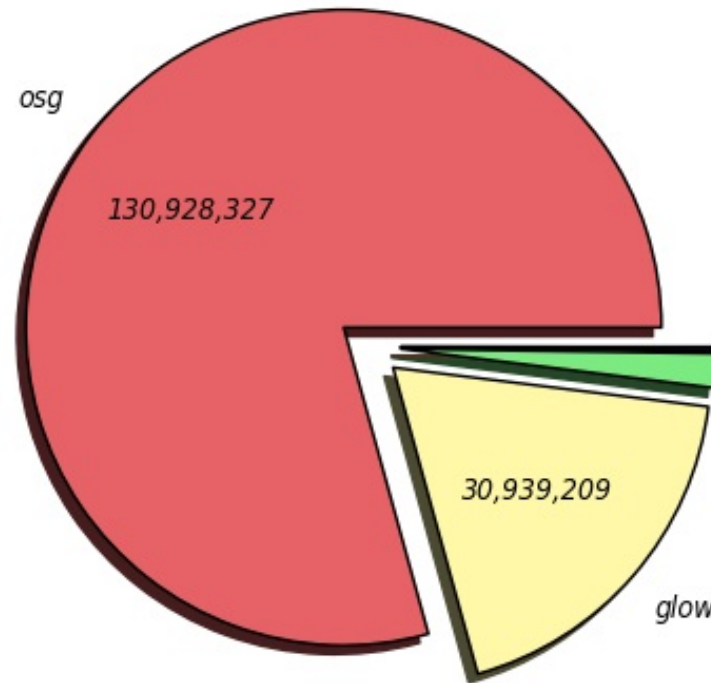
52 Weeks from Week 43 of 2014 to Week 43 of 2015



atlas (311,687,097)	cms (264,522,395)	osg (130,928,365)	mu2e (38,678,776)	glow (30,939,222)
nova (24,436,003)	dosar (23,657,163)	minos (14,529,382)	gridunesp (13,864,263)	alice (13,219,298)
minerva (9,319,821)	dune (9,245,772)	cdf (7,304,053)	mars (6,027,185)	Other (5,435,872)
sbgrid (2,869,721)	seaquest (2,846,560)	microboone (2,582,691)	darkside (1,467,228)	lar1nd (1,309,642)

# OSG Opportunistic Use

*Wall Hours by VO (Sum: 165,115,145 Hours)  
52 Weeks from Week 43 of 2014 to Week 43 of 2015*



■ osg (130,928,328)

■ glow (30,939,209)

■ sbgrid (2,869,721)

■ hcc (322,219)

■ gluex (55,668)



# Who is Using the OSG?

- Astrophysics
- Biochemistry
- Bioinformatics
- Earthquake Engineering
- Genetics
- Gravitational-wave physics
- Mathematics
- Nanotechnology
- Nuclear and particle physics
- Text mining
- And more...



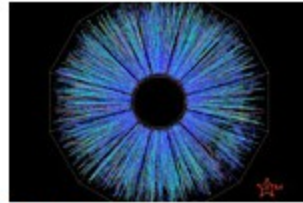
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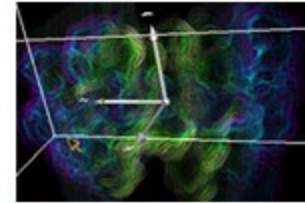
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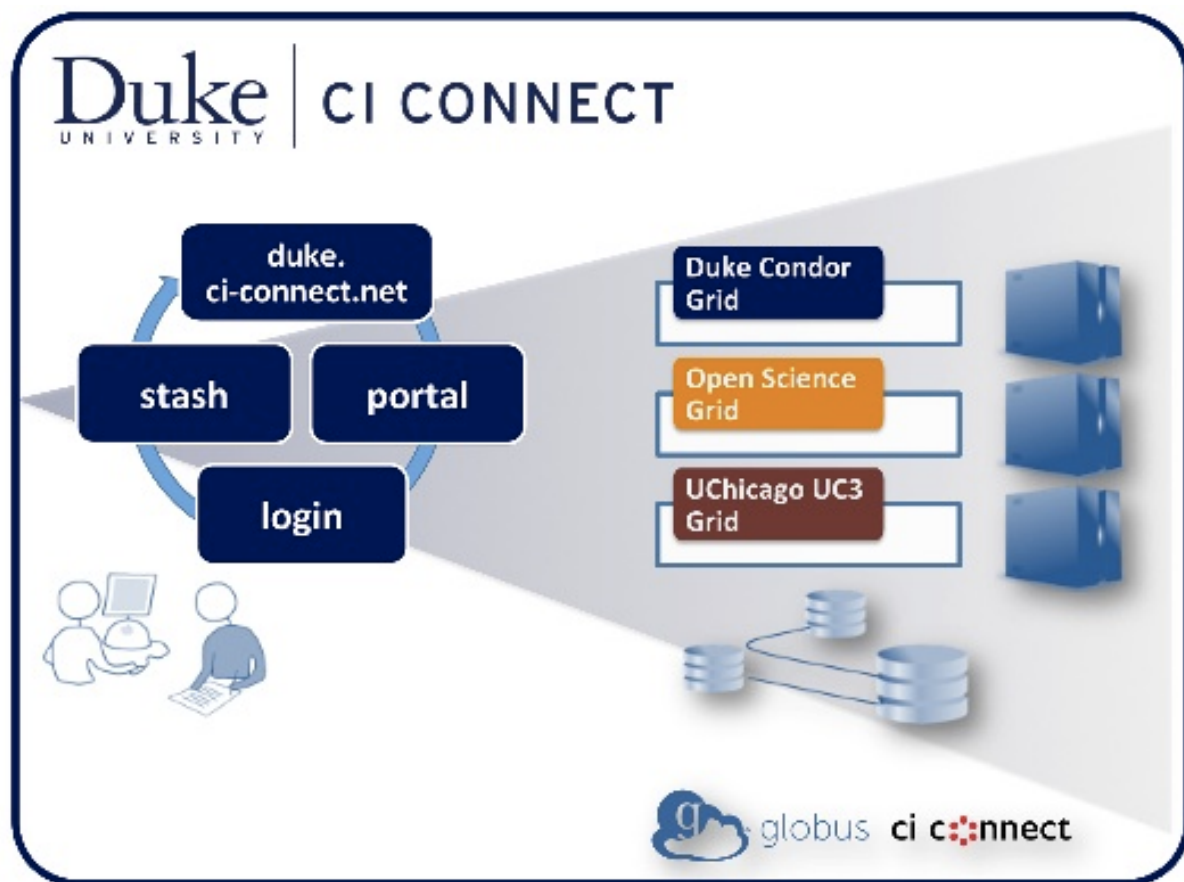


# OSG Entry Paths

**There are three simple ways:**

- OSG Connect
  - Connects directly to the OSG
- Duke CI-Connect
  - Connect to OSG, Duke Compute
  - Cluster (DCC), plus the “UC3” cluster at Uchicago
- Connect Client
  - Use Duke Ci-Connect from the DCC login server

# Duke Ci-Connect



Special version of OSG Connect specifically for Duke users and resources.

Use the Duke Compute Cluster, OSG and UC3 together.

# OSG Jobs

- **High Throughput Computing**

- Sustained computing over long periods of time. Usually serial codes, or low number of cores threaded/MPI.

- **vs. High Performance Computing**

- Great performance over relative short periods of time. Large scale MPI.

- *Distributed HTC*

- No shared file system
- Users ship input files and (some) software packages with their jobs.

- **Opportunistic Use**

- Applications (esp. with long run times) can be *preempted* (or killed) by resource owner's jobs.
- Applications should be relatively short or support being restarted.

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## **These are not hard limits!**

- Checkpointing – for long jobs that are preempted
  - Many applications support built-in checkpointing
  - Job image is saved periodically so that it can be restarted on a new host after it is killed (without losing the progress that was made on the first host)
- Limited support for larger memory jobs
- “Partitionable” slots – for parallel applications using up to 8 cores
- OASIS modules – a collection of pre-installed software packages



# Submitting Jobs

## OSG Job Scheduler: HTCondor

### Basic job parts:

- Condor Submit Script
- Executable and (optionally) job wrapper
- Input files and helper scripts
- Statically linked software packages and libraries
- DAG (optional – for managing workflow)

Submit script: Text file; Provides information about the job, specific requirements (memory, etc.), executable, input arguments, file names: input, output, log. Many other optional arguments/directives.

### Steps:

Copy job files, scripts, and software to login node (or create on login node)

ssh to login node:

```
$ ssh login.osgconnect.net
```

Submit the job(s)

```
$ condor_submit helloworld.submit
```

Monitor job:

```
$ condor_q <userid>
```

Learn more about HTCondor: [HTCondor Manual](#)

# Job Wrappers

- Optional, but can be useful
- Wrap the science code in bash/perl/python/...
  - Job success check – surprisingly many science codes do not follow zero/non-zero exit code convention
  - Data staging
  - Tar / select executable / check dependencies / ...
  - Load Modules (preinstalled software packages)

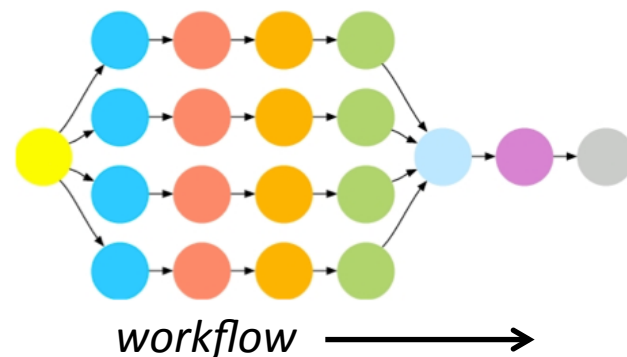
# User Tools

- **HTCondor**

- Job Scheduler used by the OSG

- **Dagman/Pegasus**

- Workflow managing tools



- **Stash**

- Temporary storage space for job staging (larger I/O jobs).
- Available through Globus Online, http, OSG/Duke Connect login nodes and worker nodes (via Parrot/Chirp).

# User Tools

- **Globus**
  - OSG Connect portal to Globus Online for managing projects and data transfers (access to stash endpoint)
- **OASIS Modules**
  - A set of pre-installed software packages (more next slide)
- **Connect Client**
  - Submit jobs to OSG directly from your home institution.
- **Tutorials**
  - Hands-on learning for different science applications

# User Tools

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  - OSG CC and data
- **OASIS**
  - A set of pre-installed software packages (more next slide)
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For more information and tutorials, see:

[https://  
support.opensciencegrid.org](https://support.opensciencegrid.org)

# User Support

## Helpdesk:

[https://  
support.opensciencegrid.org](https://support.opensciencegrid.org)

- Knowledge Base
  - User guides/tutorials
  - HTC Recipes
- Forums
- “How do I...?” articles
- Interactive online chat

## Support email:

[user-support@opensciencegrid.org](mailto:user-support@opensciencegrid.org)

The screenshot shows the Open Science Grid help desk interface. At the top, there is a navigation bar with 'Home', 'Solutions', and 'Forums' tabs. The main header includes the Open Science Grid logo and the text 'help desk', along with a 'Welcome' message and 'Login Sign up' links. Below the navigation bar, there is a search bar with the placeholder text 'Enter your search term here...' and a 'SEARCH' button. To the right of the search bar, there are two links: '+ New support ticket' and 'Check ticket status'. The main content area is divided into two columns. The left column is titled 'Knowledge base' and contains an 'Overview' section with links to 'Getting Started (4)', 'OSG XSEDE Users (1)', 'A welcome from the User Support Team', 'Communicate with us via Twitter', 'Is high throughput computing for you?', and 'Acknowledging the Open Science Grid'. Below this is the 'OSG Connect User Guide' section with links to 'Getting Started with OSG Connect (4)', 'Choosing Resources for jobs (4)', 'Registration and Login for OSG Connect', 'OSG Connect Quickstart', 'Start a Project with OSG Connect', 'The "tutorial" command', 'Steer your jobs with HTCondor job requirements', 'Large Memory Jobs', 'GPU Jobs', and 'Multicore Jobs'. The right column is titled 'Community forums' and contains an 'OSG Connect' section with links to 'Announcements (3)', 'Re-trying failed jobs - PeriodicRelease', 'High Throughput Computing Examples', and 'Working on ConnectBook tutorials'. Below this is a 'How do I...? (2)' section with links to 'What are the available software on OSG', 'How do I know if my jobs/applications can be run ...', and 'Feature Requests (2)'. The bottom of the page features the Open Science Grid logo and the text 'Open Science Grid'.

# Modules Environment

- Popular (and some requested) software packages and libraries are made available via OASIS repository
- Users don't have to transfer software with their jobs
- Modules address ease of use issues
- Many users are already familiar with modules environment
- Example: `module load python/3.4`