



Open Science Grid (OSG) Introduction for the Ohio Supercomputer Center

February 23, 2012

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Open Science Grid Ecosystem

Consortium
Infrastructures
Project
Satellites

Services:

Consulting
Production
Software



Mission: The Open Science Grid aims to promote discovery and collaboration in data-intensive research by providing a computing facility and services that integrate distributed, reliable and shared resources to support computation at all scales.

<http://www.opensciencegrid.org/>



Open Science Grid

Introduction to OSG

Resources accessible through the OSG are contributed by the community. Their autonomy is retained.

Resources can be distributed locally as a campus infrastructure.



- >30 research communities
- >100 sites
- >70,000 cores accessible

<https://oim.grid.iu.edu/oim/home>

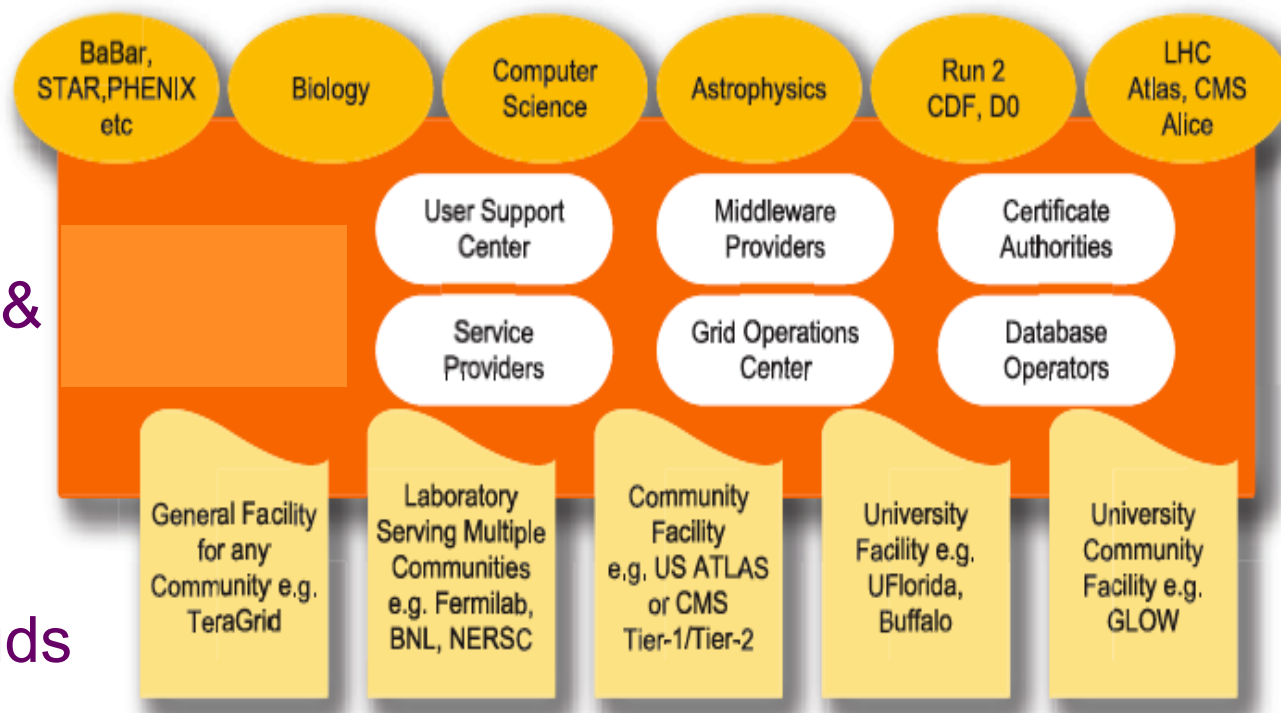
Users communities (aka VOs) and Campus Infrastructures bring:
1) Users, and/or 2) Resources

Basic Architecture

Virtual
Organizations

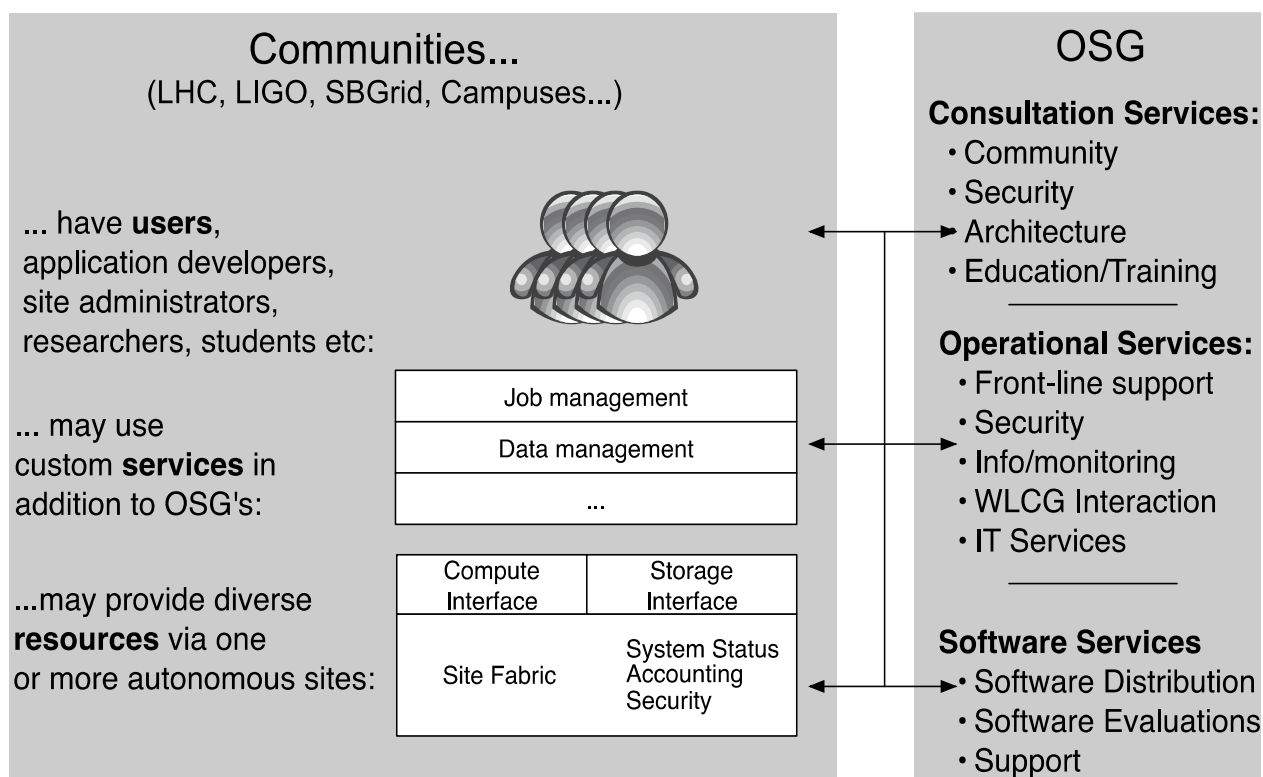
Common Services &
Software

Resources: Sites,
Campuses, Clouds



OSG Architecture

Architecture is driven by principles of Distributed High Throughput Computing (DHTC) captured in our Blueprint.



There is a sharing of software, operational services, and knowledge between the communities and OSG in each of these areas.

<http://osg-docdb.opensciencegrid.org/0000/000018/012/OSG%20Blueprint%20v2.0.pdf>

Some Contacts

OSG Staff	Responsibility
Chander Sehgal (Fermilab)	User Support Lead and Project Manager
Gabriele Garzoglio (Fermilab)	User Support – new communities integration
Marko Slyz	User Support
Marco Mambelli (UofChicago)	Site Coordination
Rob Quick (Indiana)	Operations Lead
Dan Fraser (ANL/UofChicago)	Production and Campus Infrastructure lead
Ruth Pordes (Fermilab)	Executive Director
Miron Livny (U Wisconsin)	PI and Technical Director

Introduction to OSG:

<http://osg-docdb.opensciencegrid.org/0008/000839/004/OSG%20Intro%20v23.pdf>

General OSG User Documentation:

<https://twiki.grid.iu.edu/bin/view/Documentation/WebHome>

Central ticketing system at the Operations Center <http://myosg.grid.iu.edu/about>

Email lists for community discussions <https://twiki.grid.iu.edu/bin/view/Documentation/ContactsMailingLists>

OSG Software

- OSG Software is packaged, tested, distributed as RPMs by the OSG Software group.
<https://twiki.grid.iu.edu/bin/view/SoftwareTeam/WebHome>
 - The OSG Koji-hub has over 200 RPM packages.
 - Older releases are packaged using Pacman and tarballs and use a grid middleware called Virtual Data Toolkit (VDT).
 - It also provides installation, configuration, administration tools for resources, VOs and Campus Infrastructures.
 - Alain Roy at the University of Wisconsin Madison is the Software Team Lead.
 - Software is added at the request of stakeholder needs.

Virtual Organizations (VOs)

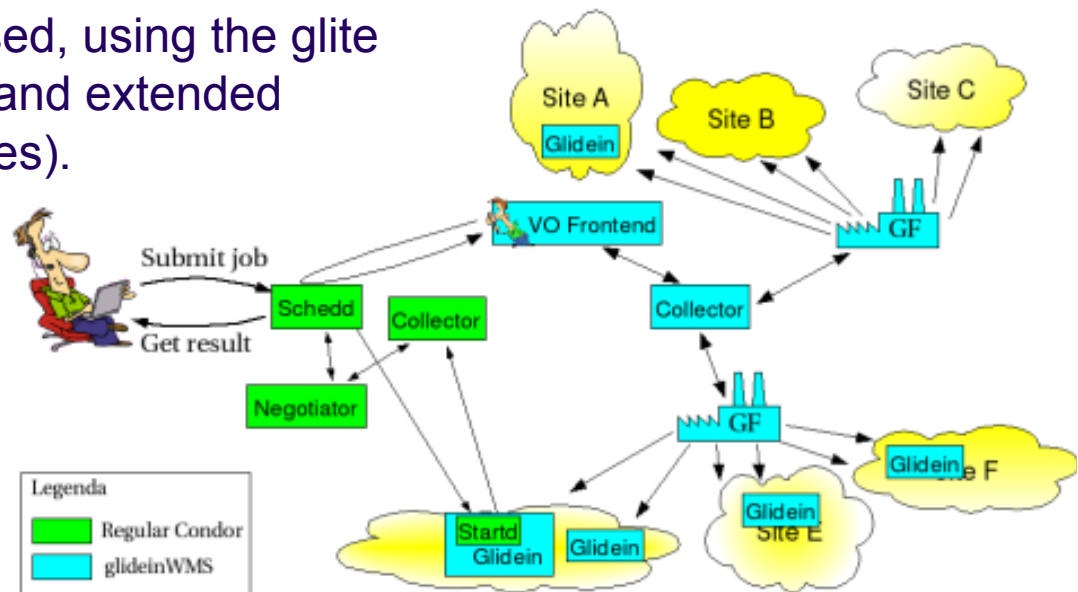
- The OSG environment is VO based.
 - VOs can be science communities (e.g. Belle, CMS) or
 - Multi-disciplinary Campus based [e.g. U-Nebraska(HCC), U-Wisconsin(GLOW)]
- OSG assumes VOs will register with, support and use multiple Grids as needed [e.g. EGI, UK National Grid Service (NGS)]
- Users can be members of multiple VOs
- Site resources are owned by one or more VOs.

Using the OSG

The prevalent OSG job submission mechanism is via Glide-ins which submit Pilot jobs to Gram gatekeepers, where the Pilots then create a Condor overlay environment across the sites and manage the user job queues and execution.

Sites also accept many other job submission mechanisms: gliteWMS*, Globus, PANDA.

Security is X509 PKI certificate based, using the glite VO Management System (VOMS) and extended attributes (including groups and roles).



* European Grid Infrastructure (EGI) Lightweight Middleware for Grid Computing

OSG Site

- An OSG Site (one or more Resources) provides one or more of the following:
 - Access to local computational resources using a batch queue
 - Local storage of and access to data using a distributed file system.
 - Remote access to data through the Storage Resource Management Interface (SRM)
 - Access to users to use external computing resources on the Grid.
 - The ability to transfer large datasets to and from remote sites.
- An OSG site offers access to these resources to grid users.
 - The policies and priority of use are determined locally by the site owners.
 - Typically the owner VO has highest priority, other “like” VOs have middle priority and the rest of the community has a lower “opportunistic” access.

What does a Site Owner Agree to?

- Offer services to at least one VO within OSG.
 - While fair access is encouraged, you need not offer services to all communities within OSG
- To advertise accessible services accurately
- To sign the “OSG Appropriate Usage Policy”
 - Do not knowingly interfere with the operation of other resources
 - Do not breach trust chains, be responsible and responsive on security issues

Requirements: System and Software

- There are no specific hardware requirements but there are recommendations as to the size of memory, local disk, server nodes depending on the expected usage.
- The OSG software supports several different Linux flavors of operating system:
 - Scientific Linux5 is currently the most used.
 - We also support some packages in CentOS and Debian
 - Scientific Linux6 is on the horizon (already in use by LIGO, expected to be needed by US LHC soon).
- OSG Software Stack
 - The current software release is RPM based (OSG 3.0).
 - Previous software releases used Pacman (a tarball based software installer) for distribution and installation.
- Worker Nodes
 - No specific requirement
 - Expect site to install the OSG Worker Node Client which is in practice needed for most VO applications

Requirements: To support the Users

- Mapping from Grid credentials to local Unix accounts done using GUMS or Gridmapfile:
 - Some VO prefer group accounts, some require pool accounts
 - None are privileged
- Some sites use Glexec* to map the Pilot user to the actual User credentials.
<https://twiki.grid.iu.edu/bin/view/ReleaseDocumentation/InstallConfigureAndManageGUMS>
- User and/or groups ids should be mapped to allow consistent file access

*<https://www.nikhef.nl/pub/projects/grid/gridwiki/index.php/GLExec>

Requirements: Storage

- These requirements are revisited and adjusted periodically by agreement to match current needs of the VOs.
 - Common locations provided using Environment Variables
- Provide persistent storage space for VO applications - \$OSG_APP.
- Provide space for User/VO data
 - At least 10 GB per Worker Node
 - One of:
 - shared file system (\$OSG_DATA),
 - special file systems (\$OSG_READ, \$OSG_WRITE),
 - Convenient/local Storage Element (\$OSG_DEFAULT_SE)
 - Consistent data access across the resource (gatekeeper and all nodes)
- Provide local scratch space, \$OSG_WN_TMP

<https://twiki.grid.iu.edu/bin/view/Documentation/Release3/LocalStorageConfiguration>

Requirements: Network Interfaces

- Grid Accessible Interfaces and Services
 - Public IP, name in DNS
 - Connection requirements specified in the installation and firewall documents
 - <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/FirewallInformation>
 - <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/InstallRSV>
- Worker nodes
 - No specific requirement, but must be able to access updates to the Certificate Revocation Lists.
 - VO are encouraged not to require persistent services on Worker Nodes
 - Most VOs use some outbound connectivity – but OSG supports sites that do not.

Additional Slides

\$OSG_APP

- can be read-only mounted on the worker nodes in the cluster
- Clusters can allow installation jobs on all nodes, only on the gatekeeper, in a special queue, or not at all
- Only users with software installation privileges in their VO (if supported by the VO) should have write privileges to these directories.
- At least 10 GB of space should be allocated per VO.

How a typical GlideinWMS based job submission works

- For every user job slot, a pilot job process starts up.
- The pilot job sends outbound TCP traffic over HTTP to a Factory service (at UCSD or IU) and via HTTP to a host at the VO Frontend (submit site; typically each VO installs its own Frontend).
- The pilot job spawns a condor startd, which spawns a condor starter.
- The startd sends outbound UDP traffic to a single port on the frontend. This is randomly chosen (per pilot) from a range of 200 ports. This can be changed to TCP if necessary.
- The starter sends outbound TCP traffic to a port on the frontend. This is chosen randomly (per pilot) from the frontend's ephemeral ports.
- Example Hosts and ports:
 - VO Frontend glidein.unl.edu (129.93.239.145). Ports: 80, 9618-9820
 - OSG Factory is glidein-1.t2.ucsd.edu. Port 8319

Source: Derek Weitzel et al. HCC VO requirements for ATLAS sites
<http://www.usatlas.bnl.gov/twiki/bin/view/Admins/SupportingHCC.html>

Some pointers to OSG technical documentation (Twiki)

<https://twiki.grid.iu.edu/bin/view/Documentation/WebHome>



First of all

- We encourage users to contact us exchange suggestions (receive help, provide feedback)
 - <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/HelpProcedure>
- Email
 - osg-sites@opensciencegrid.org
- Web chat
 - <http://integrationcloud.campfirenow.com/6e62e>
- Jabber chat room (IM)
 - osg@conference.indiana.edu



Getting started

- You will need a Grid certificate (x509 certificate signed by a recognized CA, e.g. DOEGrids)
 - <https://twiki.grid.iu.edu/bin/view/Documentation/CertificateWhatIs>
 - <https://twiki.grid.iu.edu/bin/view/Documentation/CertificateUserGet>
- You will need host certificates (linked to the host name or alias, not IP)
 - <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/GetHostServiceCertificates>

Common structure in install documents

- Requirements
 - Certificates: How many and which certificates you will need to request
 - Networking: which ports must be open in the Firewall
- Install, Configuration and Start/Stop
- Troubleshooting (log files, procedures, ...): check here if things are not working smoothly



OSG Release 3

- RPMs for RHEL5 based OS
- <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/WebHome>
- Plan for your site
 - <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/SitePlanning>
- Prepare and install a Compute Element
 - <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/PreparingComputeElement>
 - <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/InstallComputeElement>
- Monitoring with RSV
 - <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/InstallRSV>



Share files with a Storage Element

- SRM to share your NFS file system
 - <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/InstallOSGGridFTP>
- GridFTP server only
 - <https://twiki.grid.iu.edu/bin/view/Documentation/Release3/InstallOSGBestmanSE>