

Open Science Grid at Condor Week

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Fermilab
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Open Science Grid



Outline



- OSG goals and organization
- Drivers and use today
- Middleware
- Focus and roadmap

What, Who is Open Science Grid?



- **High Throughput Distributed Facility**
 - Shared opportunistic access to existing clusters, storage and networks.
 - Owner controlled resources and usage policies.
- **Supports Science**
 - Funded by NSF and DOE projects.
 - Common technologies & cyber-infrastructure.
- **Open & Inclusive**
 - Collaboration of users, developers, grid technologists & facility administrators.
 - Training & help for administrators and users
 - Partner with peer grid projects.
- **Heterogeneous**

OSG Organization (& Condor project)

Program Oversight

OSG Consortium

Executive Director:	Ruth Pordes
Facility Coordinator:	Miron Livny
Application Coordinators:	Torre Wenaus & fkw
Resource Managers:	P. Avery & A. Lazzarini
Education Coordinator:	Mike Wilde
Engagement Coord.:	Alan Blatecky
Middleware Coord.:	Alain Roy
Ops Coordinator:	Leigh Grundhoefer
Security Officer:	Don Petravick
Liaison to EGEE:	John Huth
Liaison to Teragrid:	Mark Green
Council Chair:	Bill Kramer

& 5 year proposal submitted

4/25/06



OSG Drivers:

- **Research groups transitioning from & extending (legacy) systems to Grids:**

- **US LHC Collaborations**

- Contribute to & depend on milestones, functionality, capacity of OSG.

- Commitment to general solutions, sharing resources & technologies;

- **Application Computer Scientists**

- Real life use of technology, integration, operation.

- **Federations with Campus Grids**

- Bridge & interface Local & Wide Area Grids.

- **Interoperation & partnerships with national/international infrastructures**

- Ensure transparent and ubiquitous access.
- Work towards standards.

LIGO- gravitational wave physics;
STAR - nuclear physics, CDF, D0, - high energy physics,
SDSS - astrophysics
GADU - bioinformatics
Nanohub

NMI, Condor,
Globus, SRM

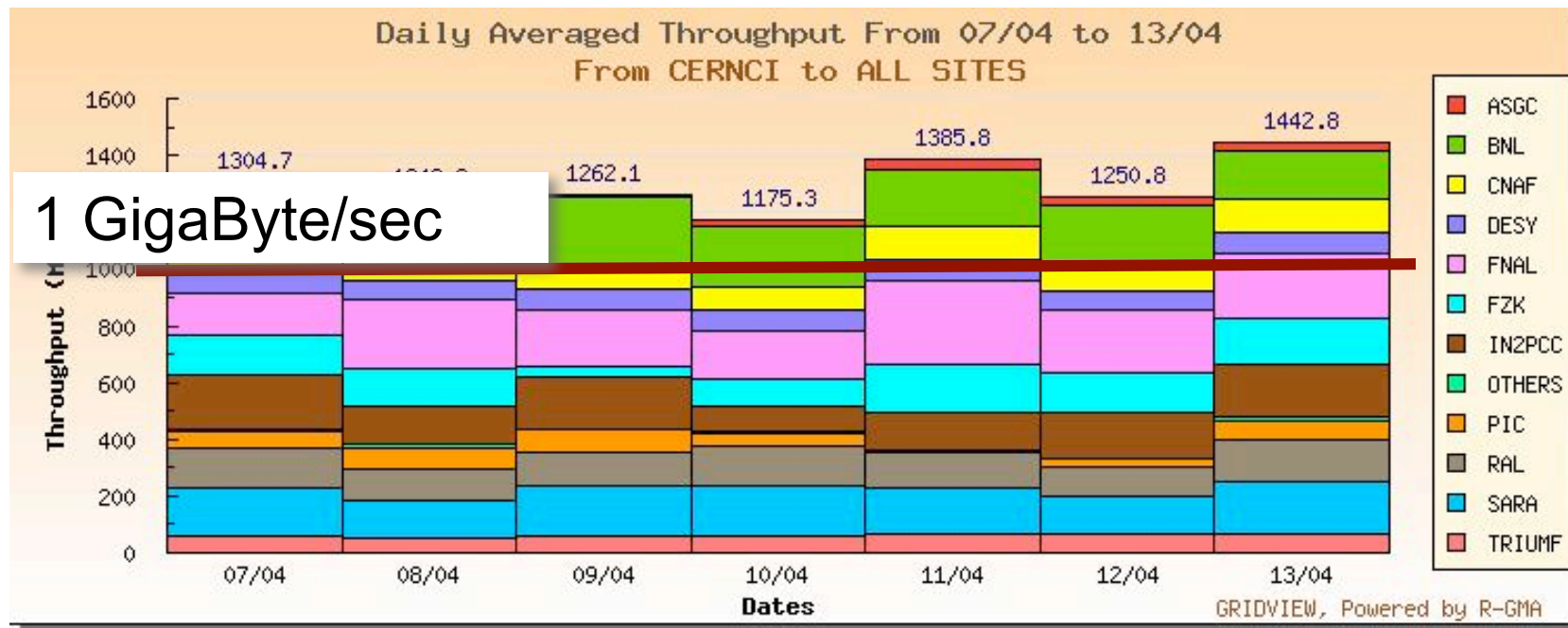
GLOW, FermiGrid,
GROW, Crimson, TIGRE

EGEE, TeraGrid,
INFNGrid

LHC Physics drive schedule and performance envelope



- Beam starts in 2008:
- Distributed System must serve 20PB of data in served across 30PB disk distributed across 100 sites worldwide to be analyzed by 100MSpecInt2000 of CPU.
- Service Challenges give steps to full system



Priority to many other stakeholders



- New science enabled by opportunistic use of resources
 - *E.g. From OSG Proposal:* LIGO : With an annual science run of data collected at roughly a terabyte of raw data per day, this will be critical to the goal of transparently carrying out **LIGO data analysis** on the opportunistic cycles available on other VOs hardware
- Opportunity to share use of “standing army” of resources
 - *E.g. From OSG news:* **Genome Analysis and Database Update system**, uses grid resources to analyse all publicly available genome sequence data used by over 2,400 researchers worldwide.
- Interface existing computing and storage facilities and Campus Grids to a common infrastructure.
 - *E.g. FermiGrid Strategy:* To allow opportunistic use of otherwise dedicated resources. To **save effort by implementing shared services**. To work coherently to move all of our applications and services to run on the Grid.

OSG Sites Today

1 to 61 of 61 <> sort by: Service

Status	Site Name	Grid Version						
●	Purdue-Physics	osg 0.4.0	●	Nebraska	osg 0.4.0	109/252	3184/4422	CS IL
●	ASGC_OSG	osg 0.4.0	●	SPRACE	osg 0.4.0	0/6	16/1646	CS NE
●	Purdue-ITaP	osg 0.4.0	●	NTU_HEP	osg 0.0.0	0/0	0/0	CS BRAZIL
●	NERSC-PDSF	osg 0.4.0	●	UERJ_HEPGRID	osg 0.2.1	147/150	0/0	CS TAIWAN
●	GRASE-CCR-ACDC	osg 0.2.1	●	FIU-PG	osg 0.2.1	0/68	2/55	CS BRAZIL
			●	STAR-WSU	osg 0.4.0	0/7	7/230	CS FL

23 VO's

More than 18,000 batch slots registered.

... but only 15% of it used via grid interfaces that are monitored.

- Large fraction of local use rather than grid use.

- *Not all registered slots are available to grid users.*
- *Not all available slots are available to every grid user.*
- *Not all slots used are monitored.*

●	SDSS_TAM	osg 0.4.0	●	VAMPIRE-vanderbilt	osg 0.4.0	0/0	0/0	CS TN
●	STAR_Sao_Paulo	osg 0.2.1	●	OSG_LIGO_PSU	osg 0.4.0	191/314	1619/1840	CS PA
●	UTA-DPCC	osg 0.2.1	●	OU_OCHEP_SWT2	osg 0.4.0	2/80	410/2929	CS OK
●	TTU-ANTAEUS	osg 0.4.0	●	hawk_csce_uark_edu	osg 0.0.0	0/0	0/0	CS AR
●	GRASE-ALBANY	osg 0.2.1	●	UWMadisonCMS:srm_v1	osg 0.4.0	NA	0/00	SS WI
●	GRASE-CCR-MAMA	osg 0.2.1	●	USCMS-FNAL-WC1-SE:srm_v1	osg 0.4.0	NA	0/00	SS IL
●	UNM_HPC	osg 0.4.0	●	BNL_ITB_Test1:srm_v1	osg 0.3.6	NA	0/00	SS NY
●	GRASE-BINGHAMTON	osg 0.2.1	●	Purdue-ITaP:srm_v1	osg 0.4.0	NA	0/00	SS IN
●	UC_Teraport	osg 0.4.0	●	Nebraska:srm_v1	osg 0.4.0	NA	0/00	SS NE
●	UFlorida-PG	osg 0.4.0	●	UCSanDiegoPG_SE:srm_v1	osg 0.4.0	NA	0/00	SS CA
●	UWMadisonCMS	osg 0.4.0	●	CIT_CMS_T2:srm_v1	osg 0.4.0	NA	0/00	SS CA
●	HAMPTONU	osg 0.4.0	●	MIT_CMS:srm_v1	osg 0.4.0	NA	0/00	SS MA
●	OU_OSCER_OSG	osg 0.2.1						
●	TACC	osg 0.4.0				814/968	805/856	CS TX



Use - Daily Monitoring

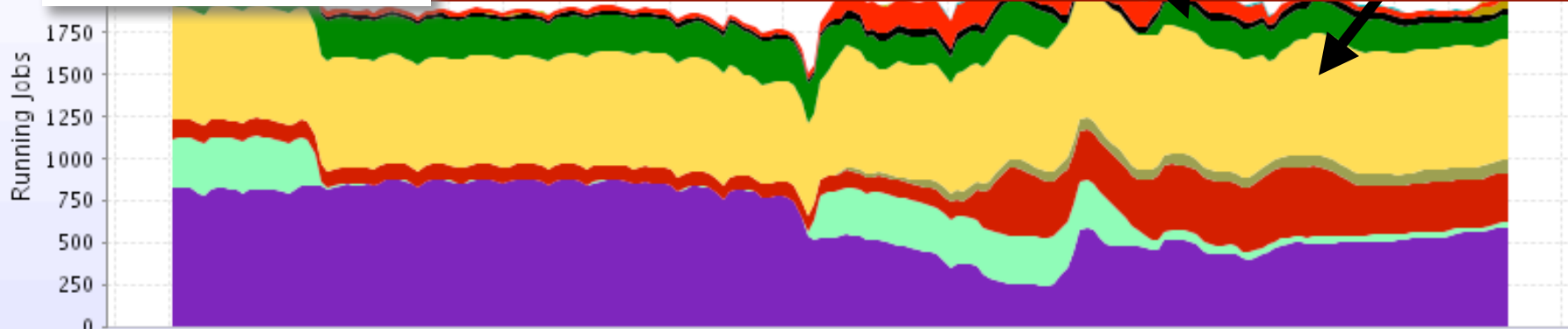
04/23/2006

Total Jobs per VO

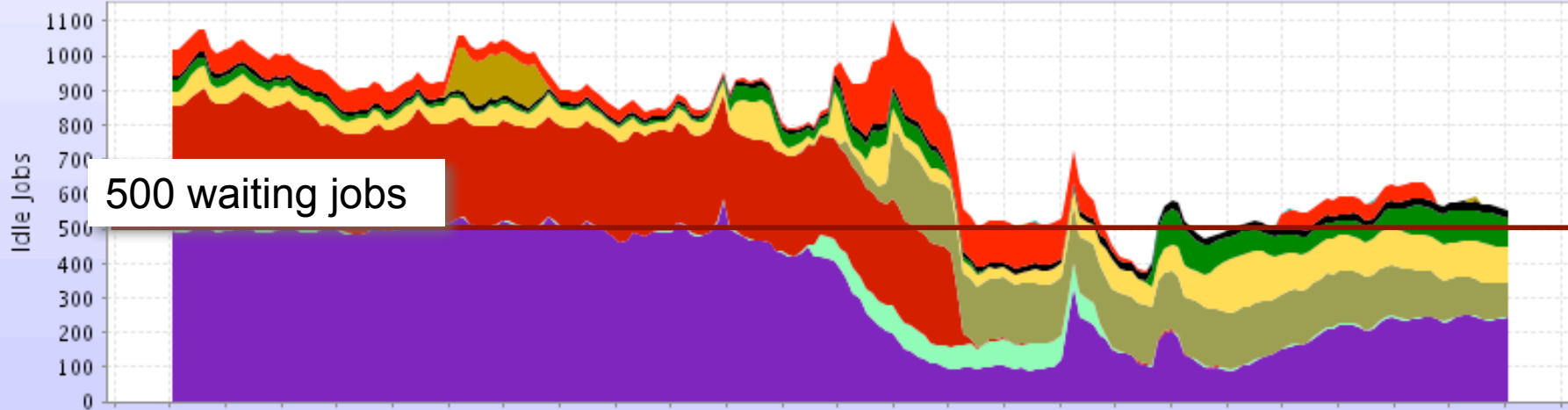
“bridged”
GLOW
jobs

Genome
analysis
(GADU)

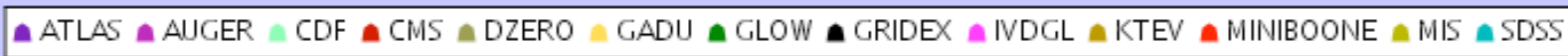
2000 running jobs



500 waiting jobs



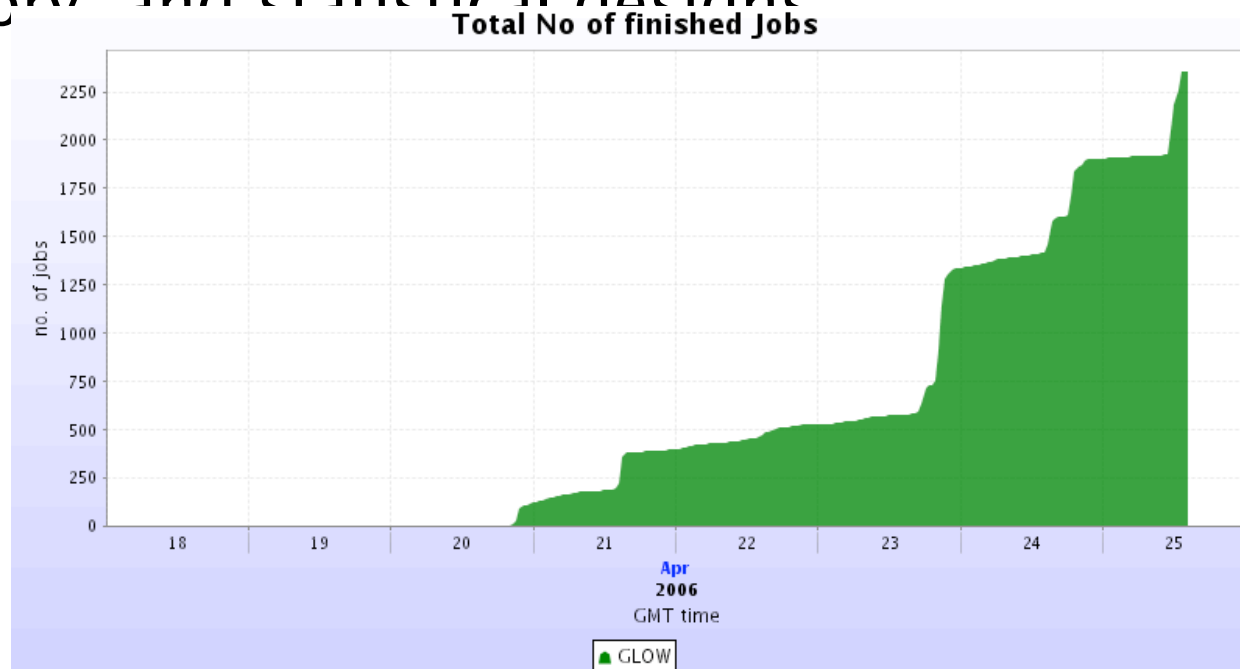
GMT time



Bridging Campus Grid Jobs - GLOW



- Dispatch jobs from local security, job, storage infrastructure and “uploading” to wide-area infrastructure.
- Fast ramp up in last week.
- Currently running the **football pool problem** which has application in data compression, coding theory, and statistical designs.



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Genome Analysis and Database Update system



- Request: 1000 CPUs for 1-2 weeks. Once a month.
- 3 different applications: BLAST, Blocks, Chisel.
- Currently ramping up on OSG and receiving 600 CPUs and 17,000 jobs a week.

Bioinformatics Group
MCS, Argonne

PUMA2 -- Evolutionary Analysis of Metabolism Login

Home Search Metabolic Reconstructions Phenotype Protein Families About

NCBI gi|523144 ... dna gyrase, a subunit [Bacillus anthracis str. 'Ames Ancestor']

NCBI related proteins	30253522, 30260201, 42735002, 42779087, 47500408, 49176972, 49183045, 49328243, 49476687, 65317474
TrEMBL	Q81W30_BACAN DNA gyrase, A subunit
PIR-REF	NF01005958
NCBI Accession	YP_016609.1
Locus tag	GBAA0006
Gene name	gyrA
Source Organism	Bacillus anthracis str. 'Ames Ancestor'
Taxon ID	261594
PIR Superfamily	SF001512 Type II topoisomerase, subunit A SF500085 DNA gyrase, subunit A

Protein sequence statistics

Classical Comparison

STRING	Sequence length (823 aa)	< 1 e ⁻¹⁰⁰	> 1
The SEED			

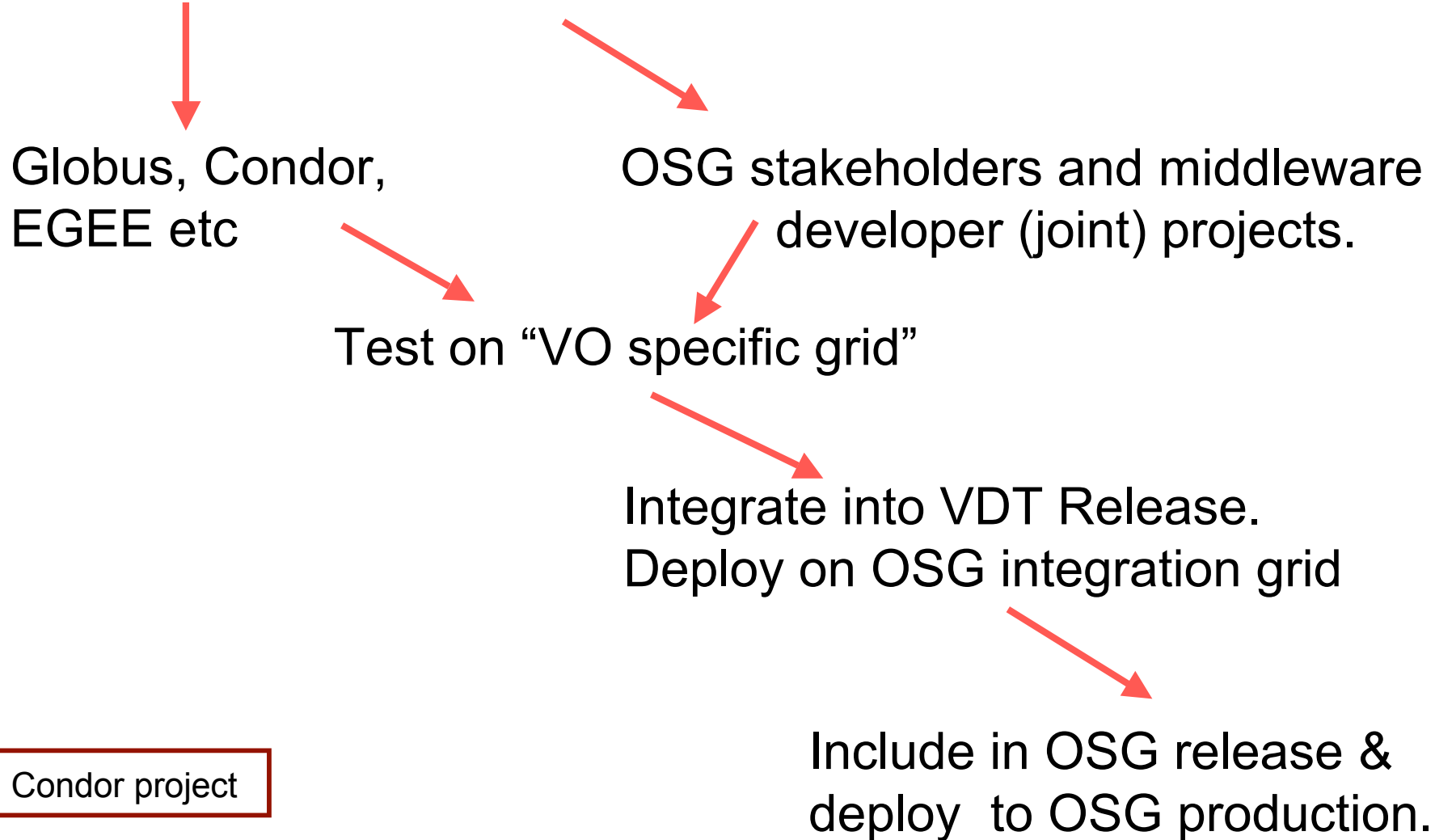
Similarity - Global

BLAST vs. nr	IPR002205	INTERPRO	DNA gyrase/topoisomerase IV, subunit A
Fasta3 vs. UniProt	IPR005743		DNA gyrase, subunit A
Blocks-Blast	IPR006691		DNA gyrase C-terminal repeat, beta-propeller
PhyloBlast		BLOCKS	No BLOCKS hits = or = no data available
BLink		BLAST vs. nr	Analyze homologous sequences from nr
Orthologs	10172619		DNA gyrase subunit A [Bacillus halodurans C-125]
Paralogs	1346238		GYRA_STAAU DNA gyrase subunit A
	13699923		DNA gyrase subunit A [Staphylococcus aureus subsp. aureus f
	15022824		DNA gyrase (topoisomerase II) A subunit [Clostridium acetobi
	153086		DNA gyrase A subunit
	15458723		DNA gyrase subunit A [Streptococcus pneumoniae R6]
	15673093		DNA gyrase subunit A [Lactococcus lactis subsp. lactis II]140:
	15922996		DNA gyrase subunit A [Staphylococcus aureus subsp. aureus f
CDART	16077075		DNA gyrase (subunit A) [Bacillus subtilis subsp. subtilis str. 1

Common Middleware provided through **Virtual Data Toolkit**



Domain science requirements.



Condor project

4/25/06

OSG allows you to

**S
U
R
F**

The Grid

Focus on a

Secure

Usable

Reliable

Flexible

Distributed Facility

Security - Management, Operational and Technical Controls

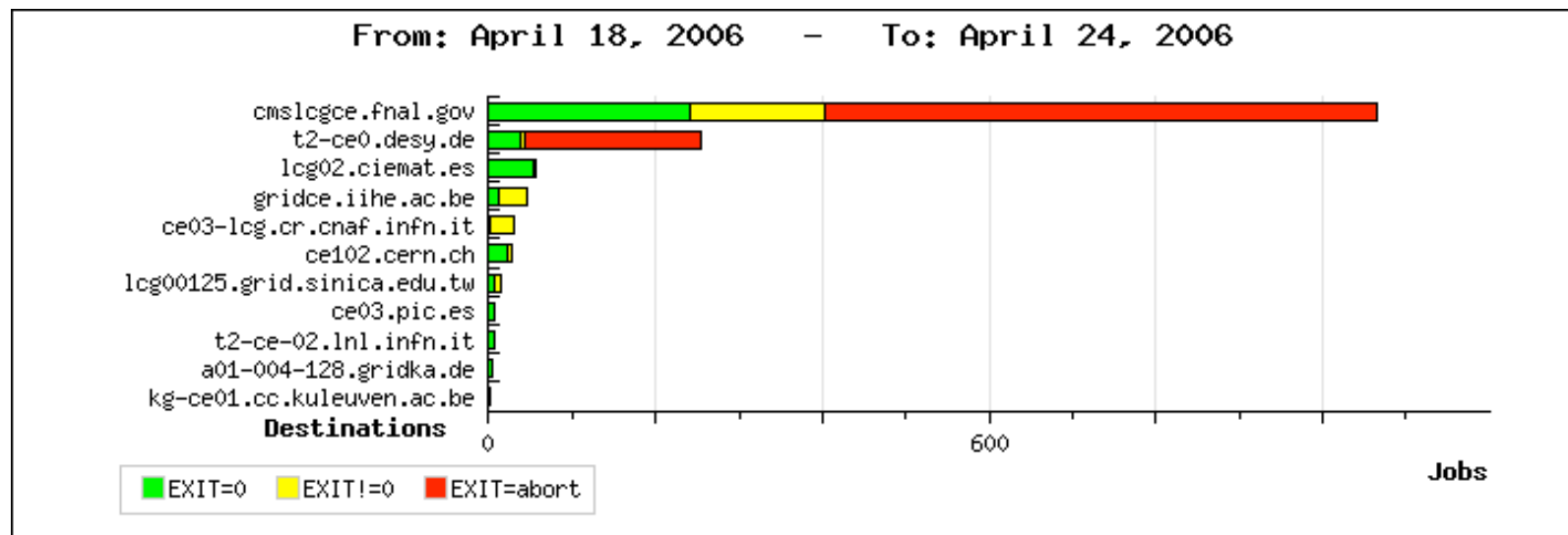


- *Management*: Risk assessment and security planning, Service auditing and checking.
- *Operational*: Incident response, Awareness and Training, Configuration management.
- *Technical*: Authentication and Revocation, Auditing and analysis. End to end *trust* in quality of code executed on remote CPU.

Usability - Throughput, Scaling, Fault Diagnosis

Open Science Grid

- Priority, quotas, write-authorization based on VO role rather than individual
- Minimize threshold of entry
- Address Errors through to the VO applications: e.g. CMS Analysis program dashboard:



Reliability - Central Operations Activities



- Automated validation of basic services and site configuration
- Configuration of HeadNode and Storage to reduce errors:
 - Remove dependence on Shared File System
 - Condor-managed GRAM fork queue
- Scaling tests of WS-GRAM and GridFTP.

Daily Grid Exerciser:

The **Error Details** section gives more details on the errors encountered.

```
grid.dpcc.uta.edu
      590 Globus error 7: an authentication operation failed
      1748 Globus error 7: authentication with the remote se
```

VO Support Matrix

Grid: OSG-ITB OSG ACDC TeraGrid Ad-Hoc

Legend: ■ DNs are mapped to this VO and compute element[clickable]
■ no DNs are supported under this VO and compute element.

	CDF	DIES	DOSAR	DZERO	FERMILAB	FMRI	GAU	GEANT4	GLOW	GRASE	GRIDEX	GROW	I2U2	INDCL	UCR
cluster28.knu.ac.kr	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
grid.rit.albany.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
fiupp.ampath.net	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
rommel.cs.binghamton.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
gridgk01.rac.bnl.gov	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
gridgk02.rac.bnl.gov	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
stargrid02.rcf.bnl.gov	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
atlas.bu.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
agt.bu.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
acdc.ccr.buffalo.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
u2-grid.ccr.buffalo.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
mama.ccr.buffalo.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
joplin.ccr.buffalo.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
tier2b.cacr.caltech.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
pbs-01.grid.dartmouth.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
lqcd.fnal.gov	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
cms-xen2.fnal.gov	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
quux.fnal.gov	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
tam01.fnal.gov	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
fermigrid1.fnal.gov	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
fngp-osg.fnal.gov	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
cmsosgce.fnal.gov	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
hercules.hamptonu.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
bandicoot.uits.indiana.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
atlas.iu.edu	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

The Future?

- Enable existing and future users.
- Increase the effective throughput.

First Year View:

