ATLAS Great Lakes Tier-2 Site Report

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USATLAS Tier2/Tier3 Workshop

SLAC, Menlo Park, CA

November 30th, 2007

AGLT2 Capacity Overview

- Dedicated hardware for AGLT2 ran first jobs in April, 2007
- Cycles from mix of dual quad-core Xeons and dual dual-core Opterons
  - Currently have ~683 available job slots, each with 2GB of RAM (UM site all T3/T2)
- Aglt2.org address space includes MSU and UM sites - MSU is nearly online with their recent purchase:
  - Processing of AGLT2 jobs at MSU site ready by mid-December.
  - Panda submission will transparently distribute across both physical sites.
- Fault-tolerant disk storage capacity: 86TB online now, +160TB ready.
- 120 TB raw disk now + 54 TB soon at MSU (utilized via dCache).
- Network connectivity via dual 10Gb links over MiLR
- With MSU site online, total Si2K for AGLT2 about 2,355,132. Total storage dedicated to Tier2 nearly 500TB.

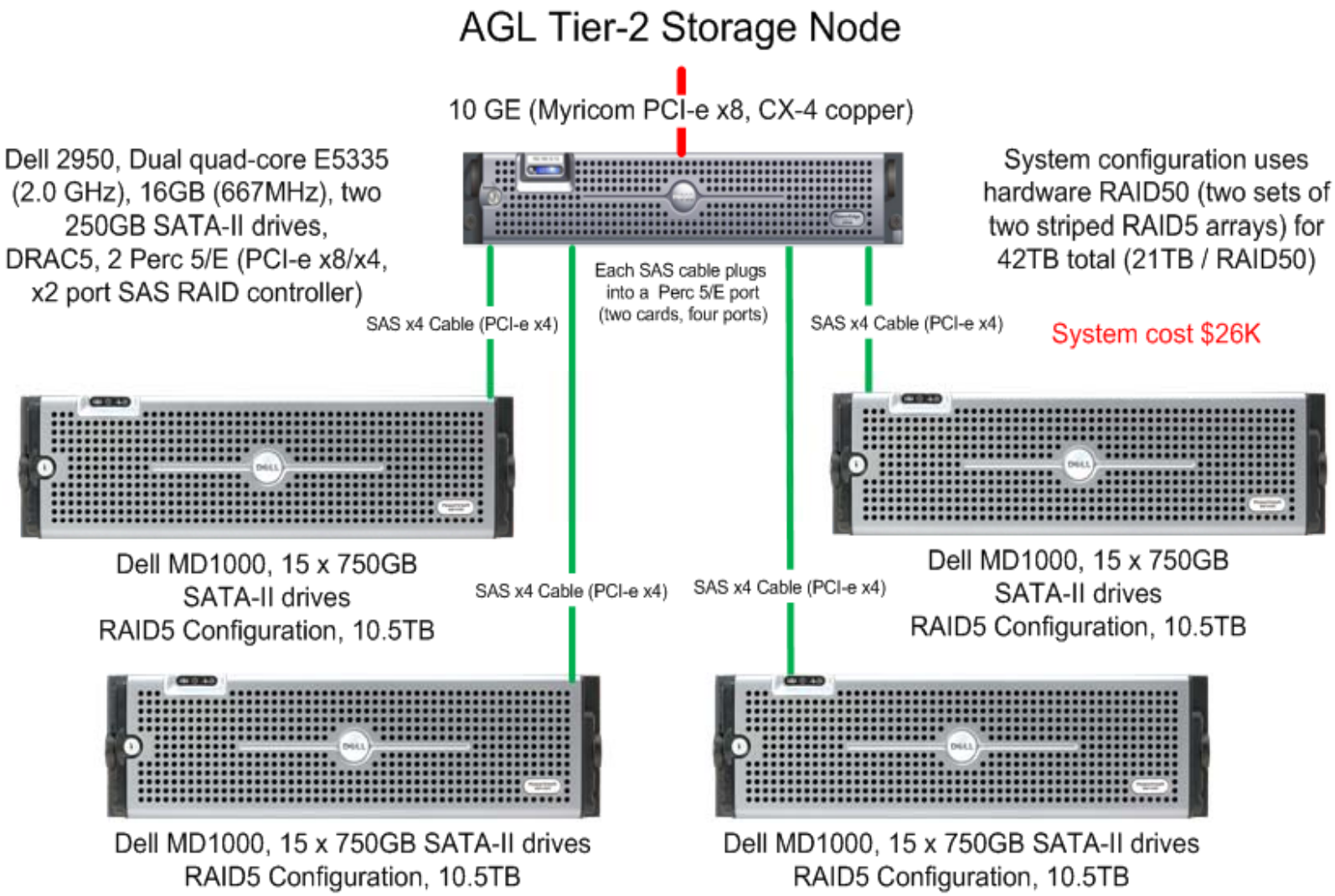
UM Cluster Composition
CPU Details

- Compute nodes
  - 79 dual quad-core 2.66Ghz Xeons in Dell PE1950, 16GB RAM
    - 48 configured with 2 x 750GB SATA disks – striped into 1.2TB RAID0 volume, used as dCache pool.
    - 51 configured with 2 x 750GB SATA disks – JBOD, each disk a dCache pool.
  - 10 dual dual-core Opteron 285, 8GB RAM, 4 250GB disks
    - Configured with 3 disks for dCache pools, remainder as system/tmp space.
    - All with Tier-3 priority, but….
      - Per MOU, Tier-2 uses half of this resource
  - Prioritized access handled by condor configuration
  - 1,412,236 possible Si2K dedicated to Tier2
  - Dual Gb NICs (1 private, 1 public)
  - New compute nodes: Good pricing - Dell 1950 dual quad-core Intel systems about $3,600. Purchased 52 at UM, 54 at MSU.

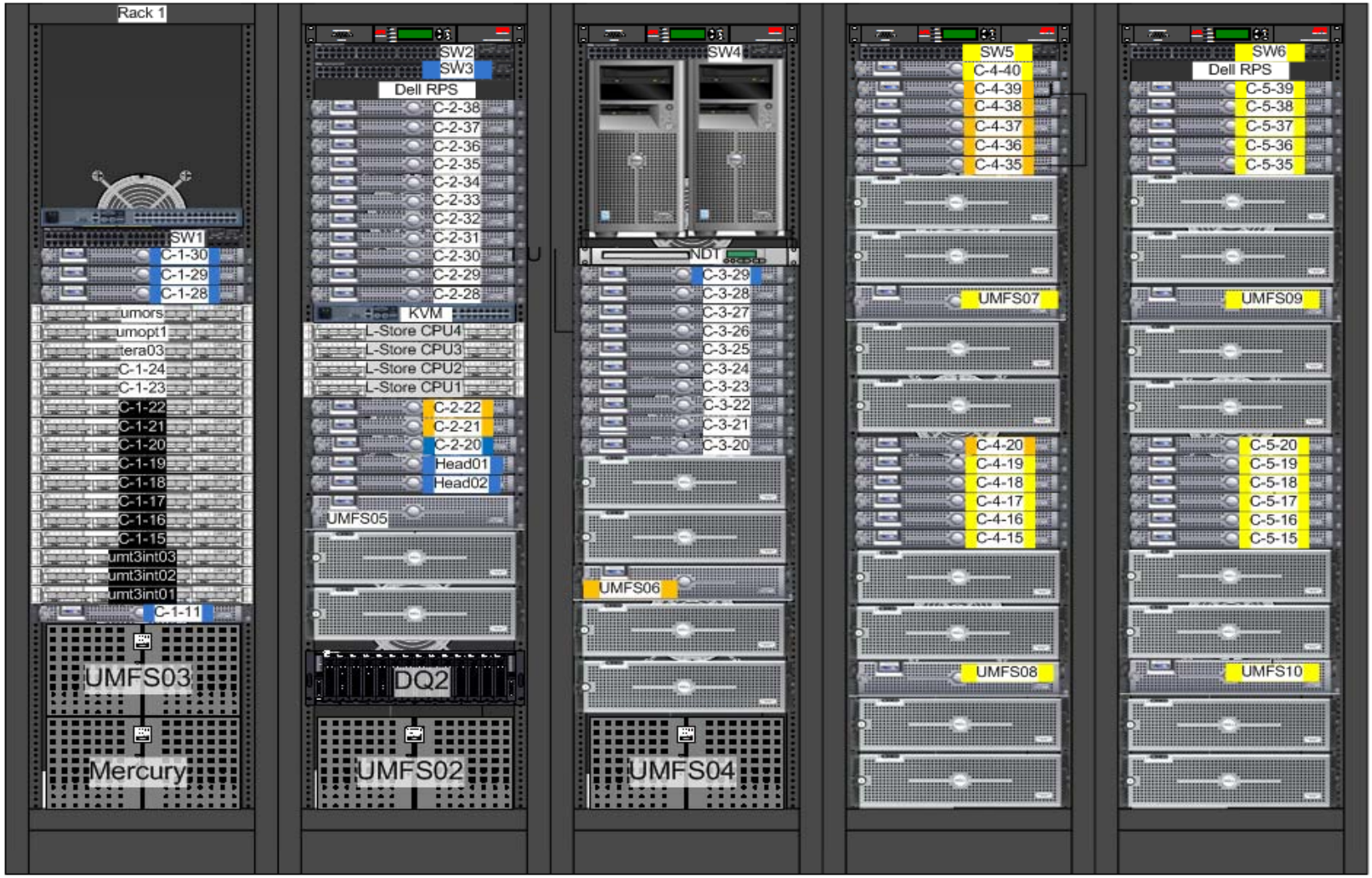
UM Cluster Composition
Storage Details

- Dedicated Tier2 Disk Storage
  - ~120TB raw dCache + 40TB RAID50 dCache write pools.
  - 46TB served via NFS, RAID5|6 volumes.
  - 160TB RAID space ready for allocation as needed (using for tests while we can).
  - 7.5TB for muon calibration files
  - Dual NICs (1Gb private, 10Gb public)
  - New storage node: Dell PE2950 with four MD1000 shelves (see supplemental diagram). Delivers **40TB RAID50** for just under $25,000. Purchased 6 at UM, 5 at MSU. Also purchased 3 PE2950 for ~$7000 with no MD1000 for use as new headnodes.
- Tier3 Storage
  - One 40TB PE2950 RAID50 storage node, NFS exported.
  - Various smaller RAID6 volumes, 43TB.
  - 83TB total available via NFS mounts.

New Storage Node



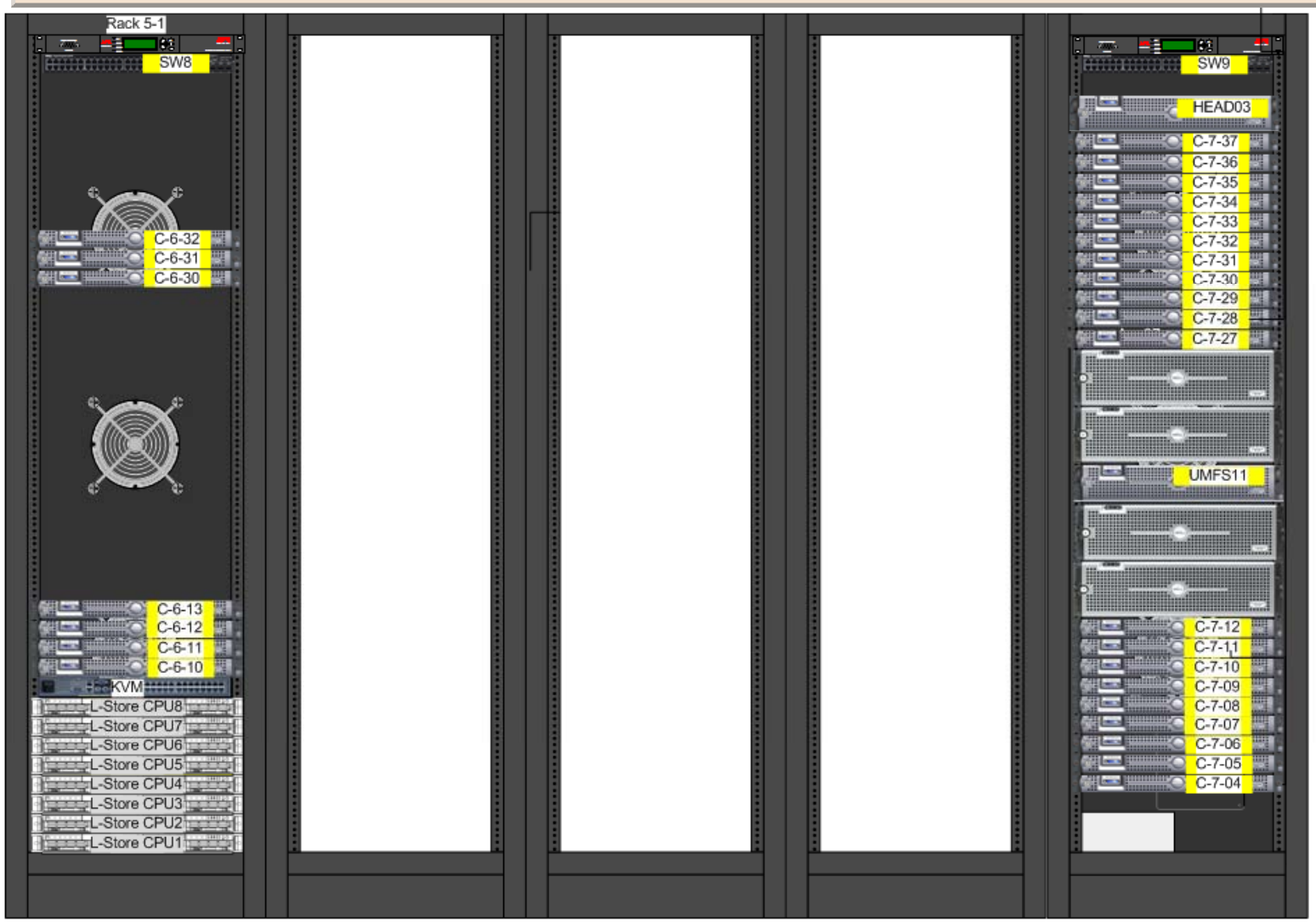
UM Rack Layout ~ November 2007



May 2007

Oct. 2007

UM Rack Layout ~ November 2007



Oct. 2007

UM Installation

MSU Cluster Composition

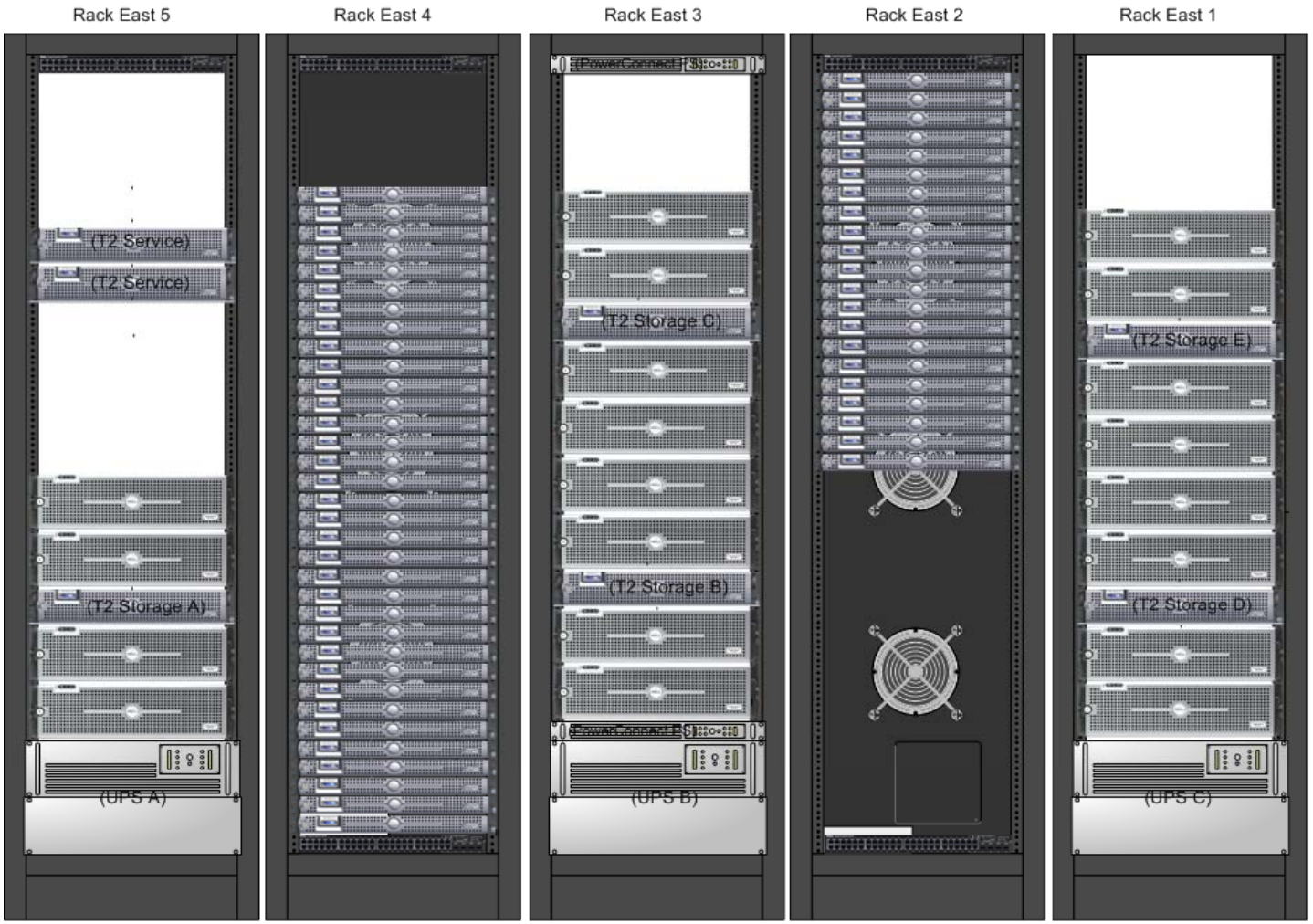
- UM and MSU submit bid request jointly, obtained same pricing.
- Compute Nodes
  - 54 PE1950 compute nodes 16GB RAM, Dual quad-core Xeon 5355 (2.67Ghz), 2 x 750GB SATA HD.
  - No RAID, drives allocated with 2 dCache partitions and job /tmp space.
- Total SPECint_2000 at MSU = 940,896 Si2k.
- Storage Nodes
  - 5 Dell PE2950 storage nodes with MD1000 disk units and 225TB of raw space for allocation in AGLT2.
  - Details of allocation, dCache vs NFS, not yet determined but will match UM
- Physical infrastructure done, 10G external network connected to world now.

  Compute nodes allocated (Rocks cluster tools used for allocation, as at UM).

MSU Site

- Power: 150 KW Liebert PDU
- Cooling: 30 Ton Liebert Airhandler
  - additional unit to be added early next year
- Safety: Vesda smoke system
- Size: 400 Sq. Feet, 20 Racks.
- Despite enormous amounts of frustration and investment of time/money, everything has come through and MSU has a very nice facility. Many congratulations to MSU people on overcoming the challenges renovating the space - we are installed, networked, and ready to turn on!

MSU Rack Layout – November 2007



East Row - MSU BPS Room 1221 - AGLT2 Only

24-Sep-2007

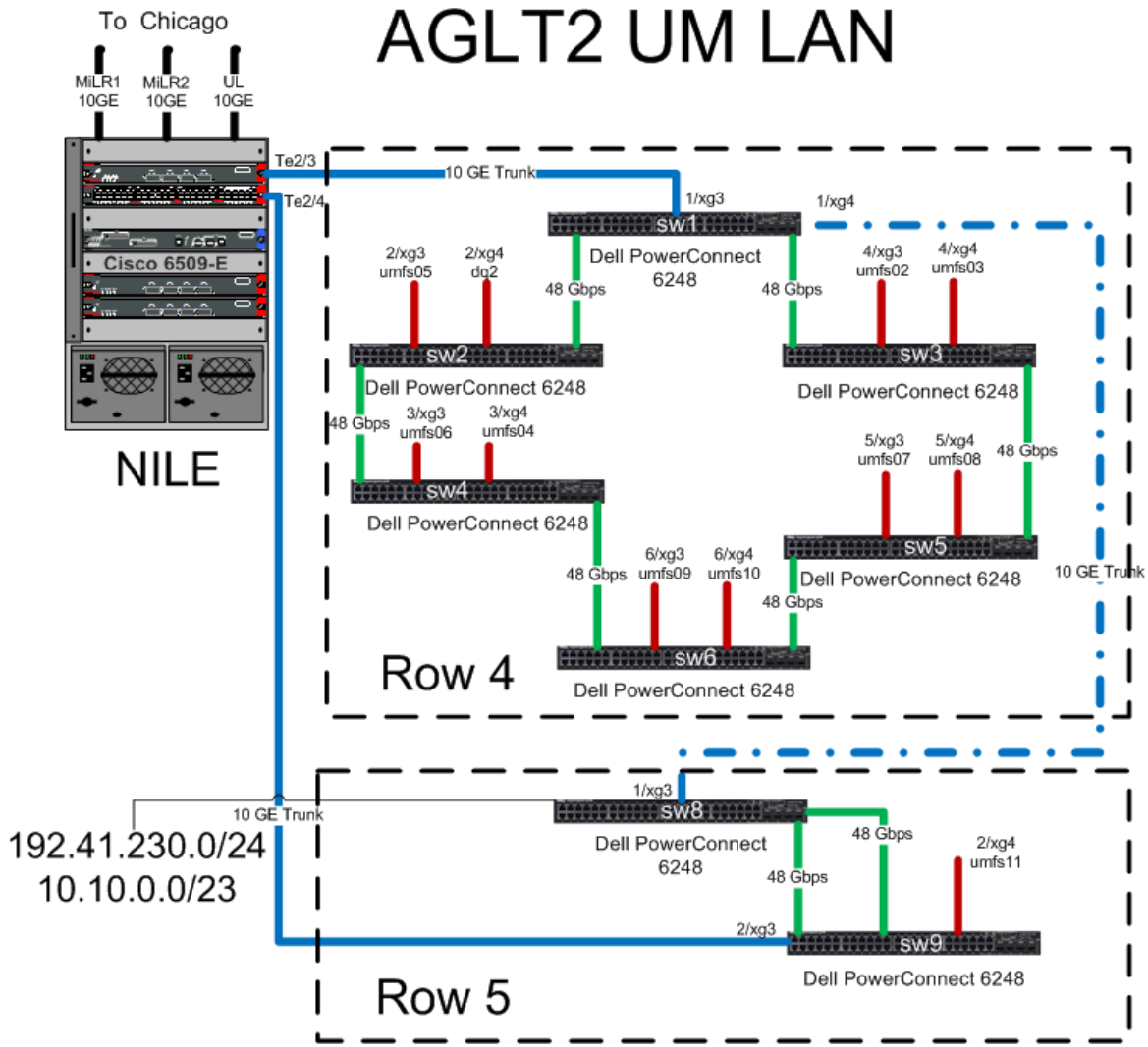
MSU Installation

MSU Installation

Network Equipment

- Network switches: Dell PowerConnect 6248 - stacking modules (48Gbps) 48 copper 10/100/1000 ports and two 10 gig module slots.
- UM has 8 switches in stacks of 2 and 6 units. MSU purchased 6 units, 5 stacked and 1 spare. Pricing under $3000 per unit, including stacking/uplink modules and CX cables.
- Reliability problems at UM site. Switch has many software bugs exacerbated by large stacks and complex VLAN arrangements. Some hardware failures (2 of 8 units at UM since April 07).
- Dell support not prepared for complex configurations, and often unreceptive and/or unwilling to acknowledge that the switch is not behaving as documented.

Network Architecture



Remote Site Access

- Raritan KVM for console access to non-Dell machines.
- DRAC access to Dell consoles – unfortunately IE only.
- DRAC Virtual Media – remote installations, works simply and reliably.
- Serial Console IP servers for access to switches.
- APC power infrastructure, remotely switch outlets.

FY08 Plans for AGLT2

- September 2007 UM/MSU combined spent around $625K on storage/compute:
  - 11 storage nodes ~ **460 TB**, 106 compute nodes for **~ 1635 kSI2K** additional CPU
- UM/MSU - tentatively planning to purchase in Spring, around $400K-$500K
  - If we spend the equipment money for the **whole next fiscal year** AND use some of our local leveraged funds
  - Anticipate being able to acquire similar capability to the last round of purchases
- MSU – capable of significant expansion because of augmented cooling and space beyond original plans
  - Support for up to 13 more racks of similar equipment with planned cooling expansions

Software Access

- pacman kit installation to afs space
  - Mirror for Tier-3 access elsewhere
- OSG installed to AFS where read-only access required
  - OSG 0.6.0 with VDT 1.6.1i
  - Soft links back to local disk for configs and needed write access
  - Gatekeepers upgraded to OSG 0.8.0, VDT 1.8.1b via local installation.
- Gatekeeper is gate01.aglt2.org
  - Condor v6.9.4 collector located on cluster head node umopt1
  - gate02.aglt2.org is backup gatekeeper
- OS is SLC4.4 or 4.5
  - Kernel is customized for AGLT2 and UltraLight - 2.6.20-20UL3smp
  - 64-bit kernel with 32-bit compatibility libraries for code

Resource Allocation

- We use Condor 6.9.4 job scheduler. Policy on Tier-2 is:
  - Highest priority for usatlas2 (admin, software install)
  - Next highest priority for usatlas1 (ATLAS production)
  - Next highest priority for usatlas3 (US ATLAS users)
  - Lowest priority for OSG (including usatlas4)
- The Tier-3 is “integrated” with the Tier-2 provisioning (ROCKS) but has different priorities reflecting 50% contribution to the Tier-2.
- If either Tier-2 or Tier-3 is idle, the other expands to fill
  - Equilibrium when all is busy at about 80% of job slots to Tier-2
- OSG/usatlas4 limited to, at most, 16 cores
- This only applies to UM – MSU is still planning Tier3 structure

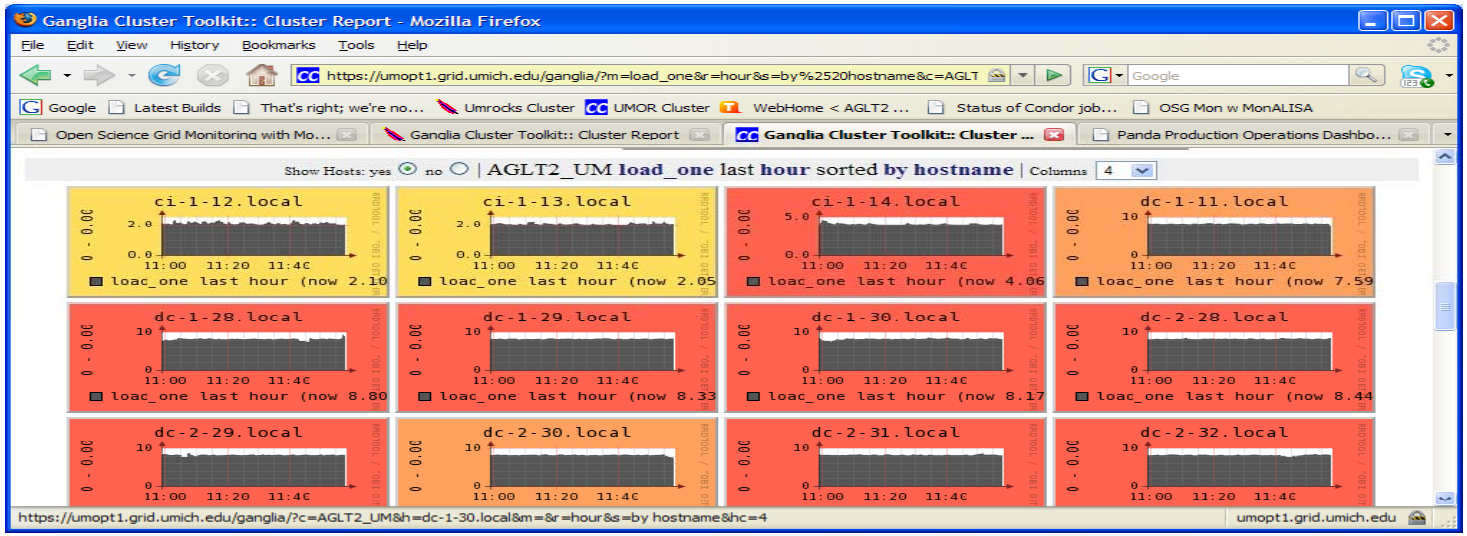
AGLT2 Analysis Queues

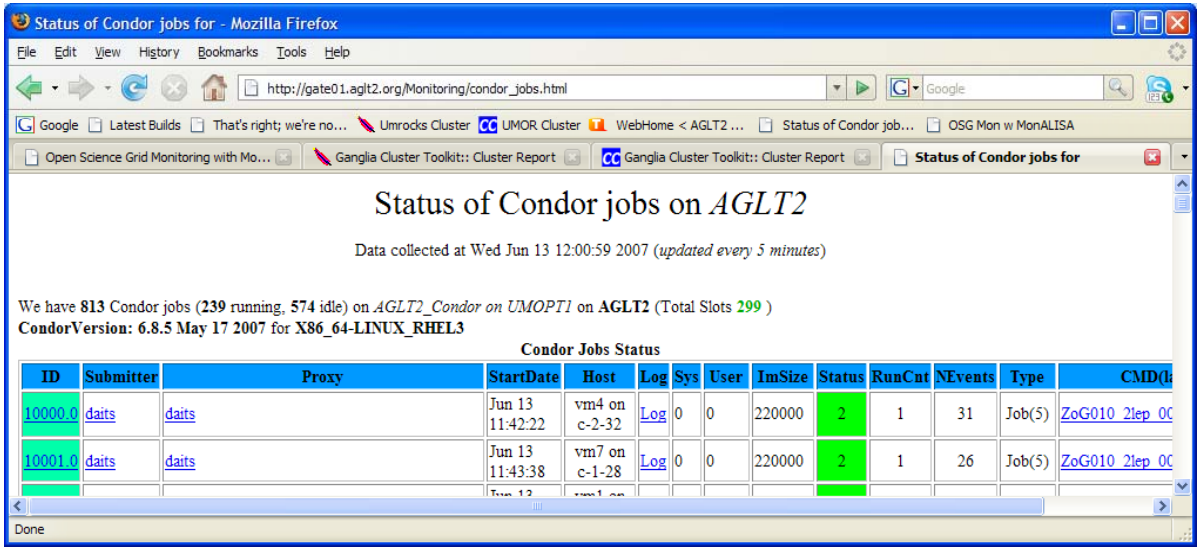
- Analysis queue is setup and tested, generally idle.
  - One dedicated 8-CPU Dell node.
  - Bob Ball is working with other T2 sites to help setup.
  - OU (Condor) and BU (PBS) volunteered first.
- All analysis queue sites are waiting for full set of AOD and NTUPLES needed for analysis jobs.

Local Monitors

- Environmental
  - APC for power, temp, humidity
- Ganglia for overall, fast view of performance
  - Perl script for details of running processes and immediate log access
- Hardware health and performance via snmp/cacti
- OS logs to central, searchable syslog-ng server
- Email notification of most “out of range” violations
- Following is a sampling of available plots

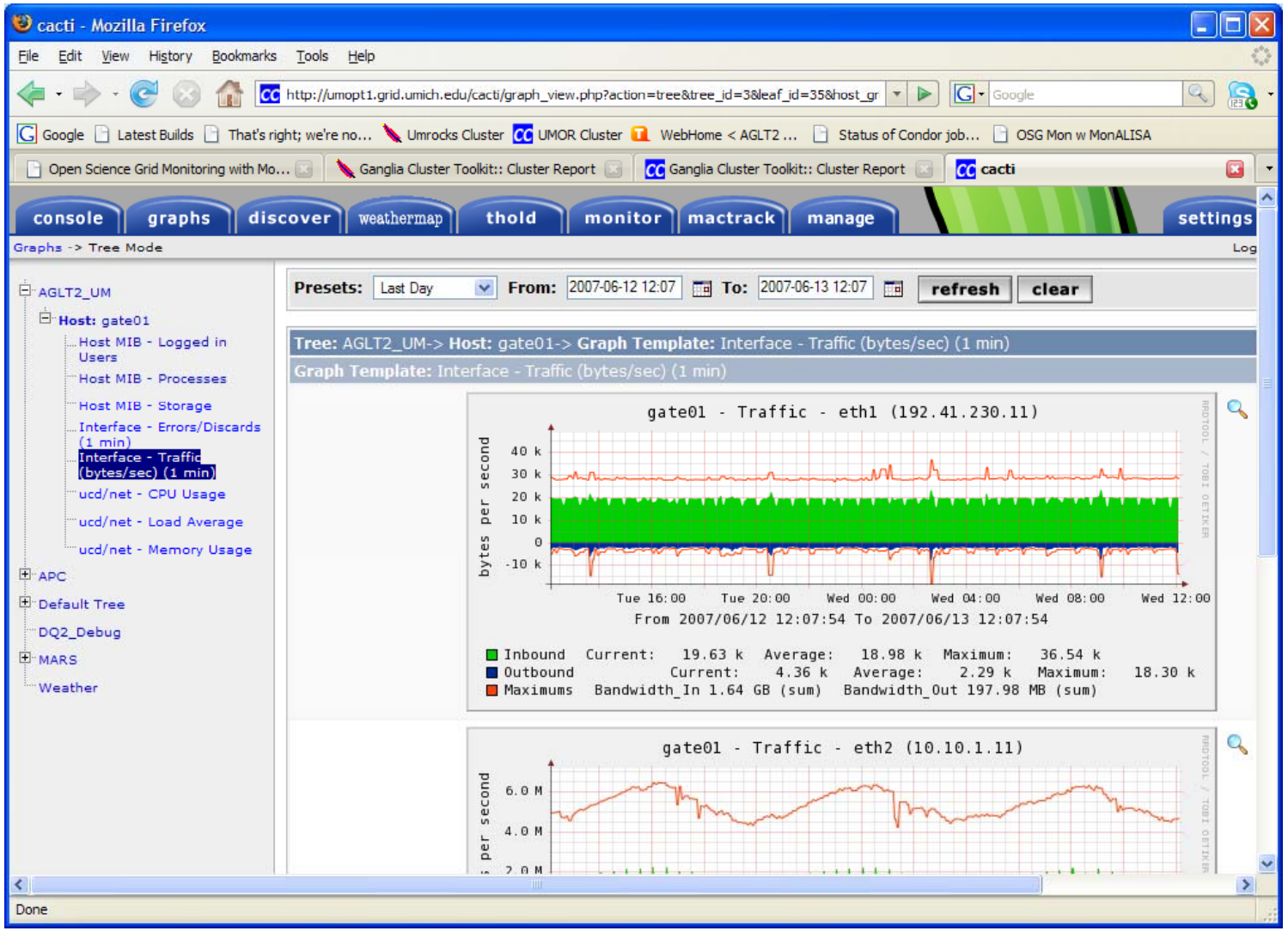
Ganglia and Perl Job Monitors



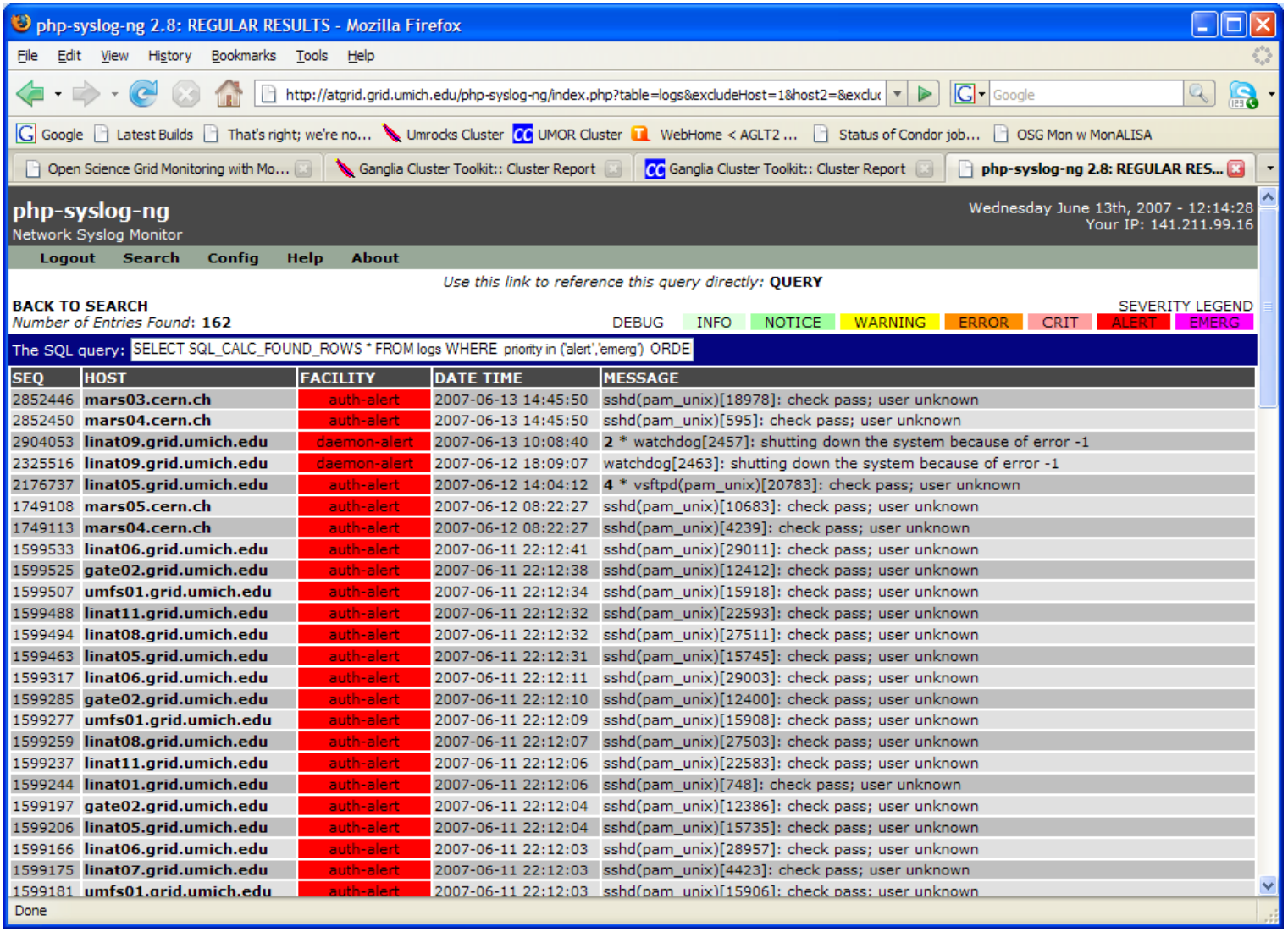


ID	Submitter	Proxy	StartDate	Host	Log	Sys	User	ImSize	Status	RunCnt	NEvents	Type	CMD(la
10000.0	daits	daits	Jun 13 11:42:22	vm4 on c-2-32	Log	0	0	220000	2	1	31	Job(5)	ZoG010_2lep_0(
10001.0	daits	daits	Jun 13 11:43:38	vm7 on c-1-28	Log	0	0	220000	2	1	26	Job(5)	ZoG010_2lep_0(

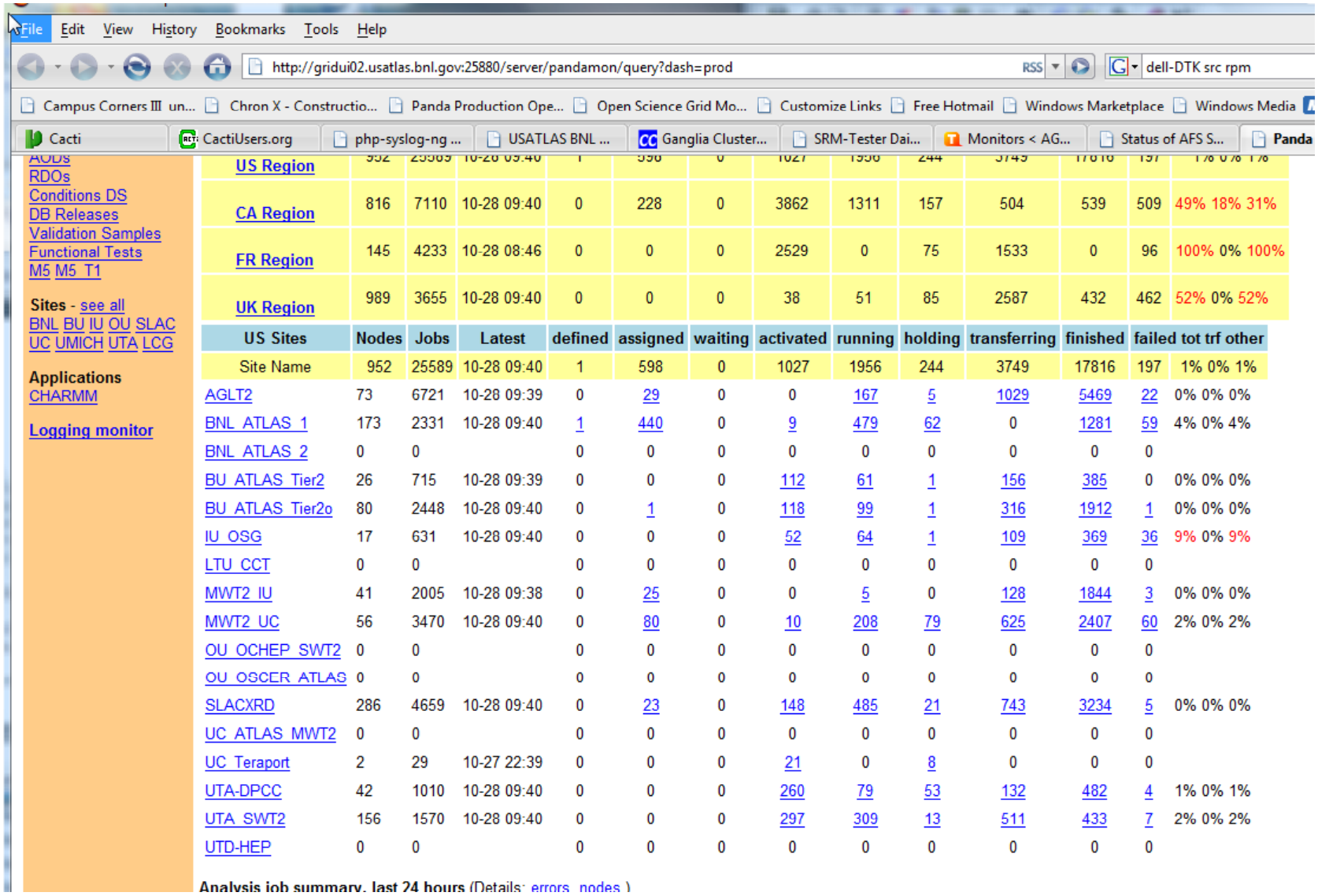
Cacti


cacti - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://umopt1.grid.umich.edu/cacti/graph_view.php?action=tree&tree_id=3&leaf_id=35&host_gr
Google Latest Builds That's right; we're no... Umrocks Cluster UMOR Cluster WebHome < AGLT2 ... Status of Condor job... OSG Mon w MonALISA
Open Science Grid Monitoring with Mo... Ganglia Cluster Toolkit:: Cluster Report Ganglia Cluster Toolkit:: Cluster Report cacti
console graphs discover weathermap thold monitor mactrack manage settings
Graphs -> Tree Mode
AGLT2_UM
Host: gate01
Host MIB - Logged in Users
Host MIB - Processes
Host MIB - Storage
Interface - Errors/Discards (1 min)
Interface - Traffic (bytes/sec) (1 min)
ucd/net - CPU Usage
ucd/net - Load Average
ucd/net - Memory Usage
APC
Default Tree
DQ2_Debug
MARS
Weather
Presets: Last Day From: 2007-06-12 12:07 To: 2007-06-13 12:07 refresh clear
Tree: AGLT2_UM-> Host: gate01-> Graph Template: Interface - Traffic (bytes/sec) (1 min)
Graph Template: Interface - Traffic (bytes/sec) (1 min)
gate01 - Traffic - eth1 (192.41.230.11)
bytes per second
40 k
30 k
20 k
10 k
0
-10 k
Tue 16:00 Tue 20:00 Wed 00:00 Wed 04:00 Wed 08:00 Wed 12:00
From 2007/06/12 12:07:54 To 2007/06/13 12:07:54
Inbound Current: 19.63 k Average: 18.98 k Maximum: 36.54 k
Outbound Current: 4.36 k Average: 2.29 k Maximum: 18.30 k
Maximums Bandwidth_In 1.64 GB (sum) Bandwidth_Out 197.98 MB (sum)
gate01 - Traffic - eth2 (10.10.1.11)
6.0 M
4.0 M
Done

Syslog-ng


php-syslog-ng 2.8: REGULAR RESULTS - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://atgrid.grid.umich.edu/php-syslog-ng/index.php?table=logs&excludeHost=1&host2=&exclu
Google Latest Builds That's right; we're no... Umrocks Cluster UMOR Cluster WebHome < AGLT2 ... Status of Condor job... OSG Mon w MonALISA
Open Science Grid Monitoring with Mo... Ganglia Cluster Toolkit:: Cluster Report Ganglia Cluster Toolkit:: Cluster Report php-syslog-ng 2.8: REGULAR RES...
php-syslog-ng
Network Syslog Monitor
Wednesday June 13th, 2007 - 12:14:28
Your IP: 141.211.99.16
Logout Search Config Help About
Use this link to reference this query directly: QUERY
BACK TO SEARCH
Number of Entries Found: 162
SEVERITY LEGEND
DEBUG INFO NOTICE WARNING ERROR CRIT ALERT EMERG
The SQL query: SELECT SQL_CALC_FOUND_ROWS * FROM logs WHERE priority in ('alert','emerg') ORDE
SEQ HOST FACILITY DATE TIME MESSAGE
2852446 mars03.cern.ch auth-alert 2007-06-13 14:45:50 sshd(pam_unix)[18978]: check pass; user unknown
2852450 mars04.cern.ch auth-alert 2007-06-13 14:45:50 sshd(pam_unix)[595]: check pass; user unknown
2904053 linat09.grid.umich.edu daemon-alert 2007-06-13 10:08:40 2 * watchdog[2457]: shutting down the system because of error -1
2325516 linat09.grid.umich.edu daemon-alert 2007-06-12 18:09:07 watchdog[2463]: shutting down the system because of error -1
2176737 linat05.grid.umich.edu auth-alert 2007-06-12 14:04:12 4 * vsftpd(pam_unix)[20783]: check pass; user unknown
1749108 mars05.cern.ch auth-alert 2007-06-12 08:22:27 sshd(pam_unix)[10683]: check pass; user unknown
1749113 mars04.cern.ch auth-alert 2007-06-12 08:22:27 sshd(pam_unix)[4239]: check pass; user unknown
1599533 linat06.grid.umich.edu auth-alert 2007-06-11 22:12:41 sshd(pam_unix)[29011]: check pass; user unknown
1599525 gate02.grid.umich.edu auth-alert 2007-06-11 22:12:38 sshd(pam_unix)[12412]: check pass; user unknown
1599507 umfs01.grid.umich.edu auth-alert 2007-06-11 22:12:34 sshd(pam_unix)[15918]: check pass; user unknown
1599488 linat11.grid.umich.edu auth-alert 2007-06-11 22:12:32 sshd(pam_unix)[22593]: check pass; user unknown
1599494 linat08.grid.umich.edu auth-alert 2007-06-11 22:12:32 sshd(pam_unix)[27511]: check pass; user unknown
1599463 linat05.grid.umich.edu auth-alert 2007-06-11 22:12:31 sshd(pam_unix)[15745]: check pass; user unknown
1599317 linat06.grid.umich.edu auth-alert 2007-06-11 22:12:11 sshd(pam_unix)[29003]: check pass; user unknown
1599285 gate02.grid.umich.edu auth-alert 2007-06-11 22:12:10 sshd(pam_unix)[12400]: check pass; user unknown
1599277 umfs01.grid.umich.edu auth-alert 2007-06-11 22:12:09 sshd(pam_unix)[15908]: check pass; user unknown
1599259 linat08.grid.umich.edu auth-alert 2007-06-11 22:12:07 sshd(pam_unix)[27503]: check pass; user unknown
1599237 linat11.grid.umich.edu auth-alert 2007-06-11 22:12:06 sshd(pam_unix)[22583]: check pass; user unknown
1599244 linat01.grid.umich.edu auth-alert 2007-06-11 22:12:06 sshd(pam_unix)[748]: check pass; user unknown
1599197 gate02.grid.umich.edu auth-alert 2007-06-11 22:12:04 sshd(pam_unix)[12386]: check pass; user unknown
1599206 linat05.grid.umich.edu auth-alert 2007-06-11 22:12:04 sshd(pam_unix)[15735]: check pass; user unknown
1599166 linat06.grid.umich.edu auth-alert 2007-06-11 22:12:03 sshd(pam_unix)[28957]: check pass; user unknown
1599175 linat07.grid.umich.edu auth-alert 2007-06-11 22:12:03 sshd(pam_unix)[4423]: check pass; user unknown
1599181 umfs01.grid.umich.edu auth-alert 2007-06-11 22:12:03 sshd(pam_unix)[15906]: check pass; user unknown
Done

Performance



File Edit View History Bookmarks Tools Help

http://gridui02.usatlas.bnl.gov:25880/server/pandamon/query?dash=prod

Campus Corners III un... | Chron X - Constructio... | Panda Production Ope... | Open Science Grid Mo... | Customize Links | Free Hotmail | Windows Marketplace | Windows Media

Cacti | CactiUsers.org | php-syslog-ng ... | USATLAS BNL ... | Ganglia Cluster... | SRM-Tester Dai... | Monitors < AG... | Status of AFS S... | Panda

AODs
RDOs
Conditions DS
DB Releases
Validation Samples
Functional Tests
M5 M5_T1

Sites - see all
BNL BU IU OU SLAC
UC UMICH UTA LCG

Applications
CHARMM

Logging monitor

US Region	952	25589	10-28 09:40	1	596	0	1027	1956	244	3749	17816	197	1% 0% 1%
CA Region	816	7110	10-28 09:40	0	228	0	3862	1311	157	504	539	509	49% 18% 31%
FR Region	145	4233	10-28 08:46	0	0	0	2529	0	75	1533	0	96	100% 0% 100%
UK Region	989	3655	10-28 09:40	0	0	0	38	51	85	2587	432	462	52% 0% 52%

US Sites	Nodes	Jobs	Latest	defined	assigned	waiting	activated	running	holding	transferring	finished	failed	tot trf other
Site Name	952	25589	10-28 09:40	1	598	0	1027	1956	244	3749	17816	197	1% 0% 1%
AGLT2	73	6721	10-28 09:39	0	29	0	0	167	5	1029	5469	22	0% 0% 0%
BNL_ATLAS_1	173	2331	10-28 09:40	1	440	0	9	479	62	0	1281	59	4% 0% 4%
BNL_ATLAS_2	0	0		0	0	0	0	0	0	0	0	0	
BU_ATLAS_Tier2	26	715	10-28 09:39	0	0	0	112	61	1	156	385	0	0% 0% 0%
BU_ATLAS_Tier2o	80	2448	10-28 09:40	0	1	0	118	99	1	316	1912	1	0% 0% 0%
IU_OSG	17	631	10-28 09:40	0	0	0	52	64	1	109	369	36	9% 0% 9%
LTU_CCT	0	0		0	0	0	0	0	0	0	0	0	
MWT2_IU	41	2005	10-28 09:38	0	25	0	0	5	0	128	1844	3	0% 0% 0%
MWT2_UC	56	3470	10-28 09:40	0	80	0	10	208	79	625	2407	60	2% 0% 2%
OU_OCHEP_SWT2	0	0		0	0	0	0	0	0	0	0	0	
OU_OSCER_ATLAS	0	0		0	0	0	0	0	0	0	0	0	
SLACXRD	286	4659	10-28 09:40	0	23	0	148	485	21	743	3234	5	0% 0% 0%
UC_ATLAS_MWT2	0	0		0	0	0	0	0	0	0	0	0	
UC_Teraport	2	29	10-27 22:39	0	0	0	21	0	8	0	0	0	
UTA-DPCC	42	1010	10-28 09:40	0	0	0	260	79	53	132	482	4	1% 0% 1%
UTA_SWT2	156	1570	10-28 09:40	0	0	0	297	309	13	511	433	7	2% 0% 2%
UTD-HEP	0	0		0	0	0	0	0	0	0	0	0	

Analysis job summary, last 24 hours (Details: errors, nodes)

Problems

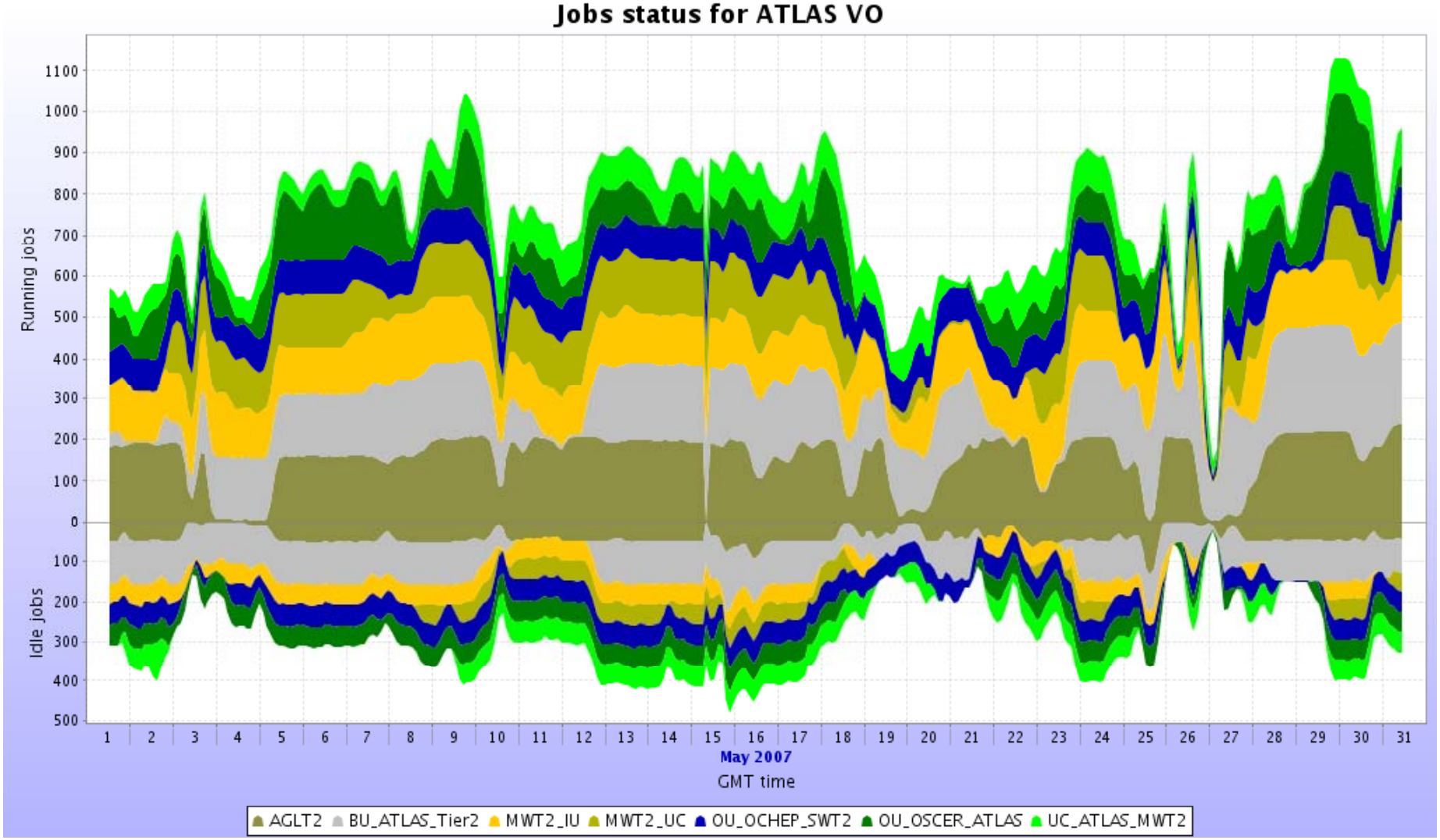
- Non ATLAS-wide AGLT2 outages from variety of sources
  - Gate-keeper, head node crashes under heavy load - planning to move both systems to more reliable equipment
  - Network outages – equipment issues.
  - NFS server crashes - Disruptive, but not fatal. We seem to have no or few of these anymore on our newer systems with the latest kernel and nfs utilities.
- Software configuration
  - Recently upgraded OSG/VDT on our gatekeeper, site operations disrupted most of a day. Upgrade was successful, and we were back online the same day.
- Accounting issues due to broken Gratia, fixed October 2007 onwards.

ATLAS Memory Limits

- We have seen jobs allocating 2.5GB or more of RAM.
- Jobs like this cause nodes to use swap RAM, which can hugely slow the node down and cause loads to rise excessively
- Some sites configure with no swap – nodes crash if a job allocates more than was planned for each job slot.
- It is possible to have the scheduler (condor) kill jobs that exceed memory limits
- An ATLAS-wide policy regarding this would be a good idea.

Summary

- AGLT2 is in good shape and will only get better.
- Accounting issues resolved as of Oct 2007.
- Dell switch problems responsible for some outages. Servers generally very reliable, though.
- OSG/VDT is up to date on the gatekeepers.
- Lots of monitors allow quick response to problems. Flexible, cross-platform/browser remote access tools are essential.
- Expansion scheduled at MSU site is very close to being finished and processing jobs. Lots of additional expansion planned.
- Review presentation by S. Mckee for more info about I/O performance tests performed at AGLT2.

Supplementary Slides

Performance – AGLT2