Performance of a USCMS Tier-3 Computing Cluster at Florida Tech

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Abstract

The Tier-3 High Performance Computing Cluster at Florida Tech is being used for data production of the CMS experiment at the CERN Large Hadron Collider as well as for local analyses and has undergone significant changes during the course of the semester. The system software has been upgraded to include the latest version of the Virtual Data Toolkit, the Grid User Management System (GUMS), and the Physics Experiment Data Exports system (PhEDEx). A development node was converted into a separate Storage Element with 64GB of RAM to replace our previous Berkley Storage Manger System configuration. Performance tests of the cluster were conducted to ensure maximum efficiency and speed and it is now achieving 941 Mbits/sec data transfer between the frontend and the Network Attached Storage (NAS). Currently the cluster is being used by several faculty members for their projects, which include the modeling of accretion flows from binary stars and the studying of propagation of solar energetic particles as well as to run our own Muon Tomography simulations.

Hardware

Figure 1: The Florida Tech Cluster is encased within one 50U rack.

The cluster consists of 20 professionally-built servers with 8 Xeon CPUs and 16GB of RAM in each machine. The NAS is a similar machine but with ~10TB of data storage in a RAID6 configuration.

Important research data is stored on the NAS. Our new storage element is a machine with 8 Xeon cores and 64GB RAM, as well as a 1TB RAID5 array.

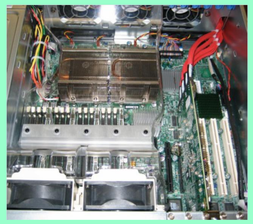


Figure 2: The NAS contains User directories and research data.

Software

We upgraded our software with the latest versions of the following programs.

Virtual Data Toolkit: The package that contains and installs all OSG software.

Grid User Management System: A piece of software that maps grid users (DN) to local cluster accounts.

Physics Experiment Data System: System that allows CMS grid users to request data transfers to/from particular sites and administrators to control the data flow for their site. It helped automate many of these low level activities.

Diagnostic Tests

In order to optimize our Network File Storage (NFS) performance we used the program DD which stands for dataset definition. It allowed us to measure the throughput between the NAS and the front end and then the NAS and the NAS. We were able to specify which size block to use and kept track of the speed at which information was written and copied.

Before

Size	WRITE	MB/s	READ	GB/s
64K	288.5	3.7	0.49	2.2
	244.89	4.4	0.49	2.2
	135	7.9	0.49	2.2
32K	82	6.5	0.24	2.2
	59.2	10.1	0.25	2.1
	41.9	12.8	25	2.1

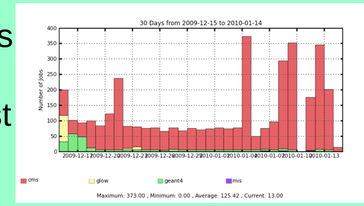
After

size	WRITE	MB/s	READ	GB/s
64k	12.7	84.4	0.42	2.5
	13.1	81.7	0.45	2.3
	13.1	81.5	0.48	2.2
32K	6.5	81.7	0.22	2.4
	6.4	83.1	0.22	2.4
	6.4	82.8	0.22	2.4

Figure 3: Excerpts from our charts comparing the results of our tests with DD before and after making changes to NFS and our RAID array.

Cluster Use

Figure 4: This graph displays the number of jobs that have ran on our cluster for the past month



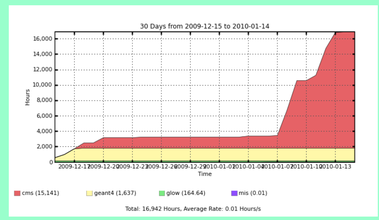
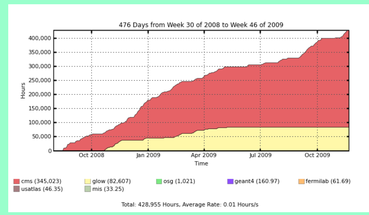


Figure 5: This graph displays the number of hours Virtual Organizations have ran jobs on our cluster for 30 days.

Figure 6: This graph displays the total number of hours VOs have ran on our cluster.



Conclusion

Our success updating and installing software along with the integration of a storage element to our hardware has marked several milestones for us. We followed up by testing the speed of the cluster. Our future plans for our project involves further expansion of our hardware including a new NAS with 24 TB of storage and 5 more grid compute nodes with dual processers.

Visit http://uscms1.fltech-grid3.fit.edu to follow this project.

References and Acknowledgments

Rocks Clusters User Guide: http://www.rocksclusters.org/roll-documentation/base/5.0/ Accessed January 2010

Open Science Grid: http://www.opensciencegrid.org/ Accessed January 2010

Condor v7.2 Manual: http://www.cs.wisc.edu/condor/manual/v7.2/ Accessed January 2010

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