TEXAS TECH UNIVERSITY™

High Performance Computing Center

Texas Tech University (TTU) – Big Tier 3

OSG Site Administrators & CMS Tier 3 workshop

10th August, 2010
ACCRE, Vanderbilt University

Poonam Mane
Graduate Assistant TTU, HPCC

Outline of this talk

- IT infrastructure at TTU
- Introduce people active in this area at TTU
- Describe range of resources available at TTU, and the fraction of those through the TTU high energy physics group for use in our Tier-3 CMS installation
- Identify areas of applicability and potentially useful improvement

Collaboration

- Large no of research groups + small no of support staff (HPCC + TTU IT department)
- Collaboration is the key
- Emphasize on IT infrastructure for research
- Effective even with minimum owned personal resources

TTU High Performance Computing Center

HPCC Staff

- Dr. Philip Smith (Sr. Director)
- Dr.James Abbott(Assoc. Director)
- Jerry Perez
- Srirangam Addepalli
- Dr.Alan Sill (Sr. Scientist)
- Jodi McMurray
- Dr. Per Andersen
- Dr. Ravi Vadapalli
- Huijun Zhu
- Poonam Mane

Purpose

- Facilitate high performance research computing
- Assist with PC to Linux migration and grid-based computing
- Provide consulting and assistance with use of HPC resources

TTU High Energy Physics

Faculty: Dr.Sungwon Lee (Dept. Chair), Dr.Richard Wigmans, Dr.Igor Volobouev, Dr. Nural Akchurin , Dr.Alan Sill (Adjunct Prof.)

Postdoc's: Efe Yazgan, Jordan Damgov

Students in TTU Tier-3 operations : Youn Roh, Chiyoung Jeong, Keng Kovitanggoon, Terence Libeiro, Poonam Mane

Students in offline CMS CSP shift : Cemile Bardak

Personnel based at TTU, FNAL, and CERN. Physics analyses carried out using a mix of resources, primarily those provided at the LPC and via CRAB.

TTU T3 is available principally to run CRAB jobs

Resources and capabilities

- Linux clusters for parallel and serial computing
- Large-scale Lustre-based data storage
- High Speed Networking
- Oracle Grid Engine (Sun Grid Engine)
- Local campus grid
- Nationwide, regional and state-wide Globus grid access
- Operational for past decade
- 15% of the total grants to TTU are generated by research groups supported by HPCC

Infrastructure and Support

Infrastructure

- Experimental Sciences Building (Main Campus)
- Reese Center
- 12 miles apart, currently connected with 1Gb network that is being upgraded to 10Gb

Support

- TTU IT department
- HPCC

Reese Campus

Antaeus (OSG and CMS Tier-3 resource)

- Production Cluster
- Mixed dual-dual core + dual-quad core Xeons
- 261.4 TB dedicated HEP (CMS) + 6TB user storage interfaced via Lustre

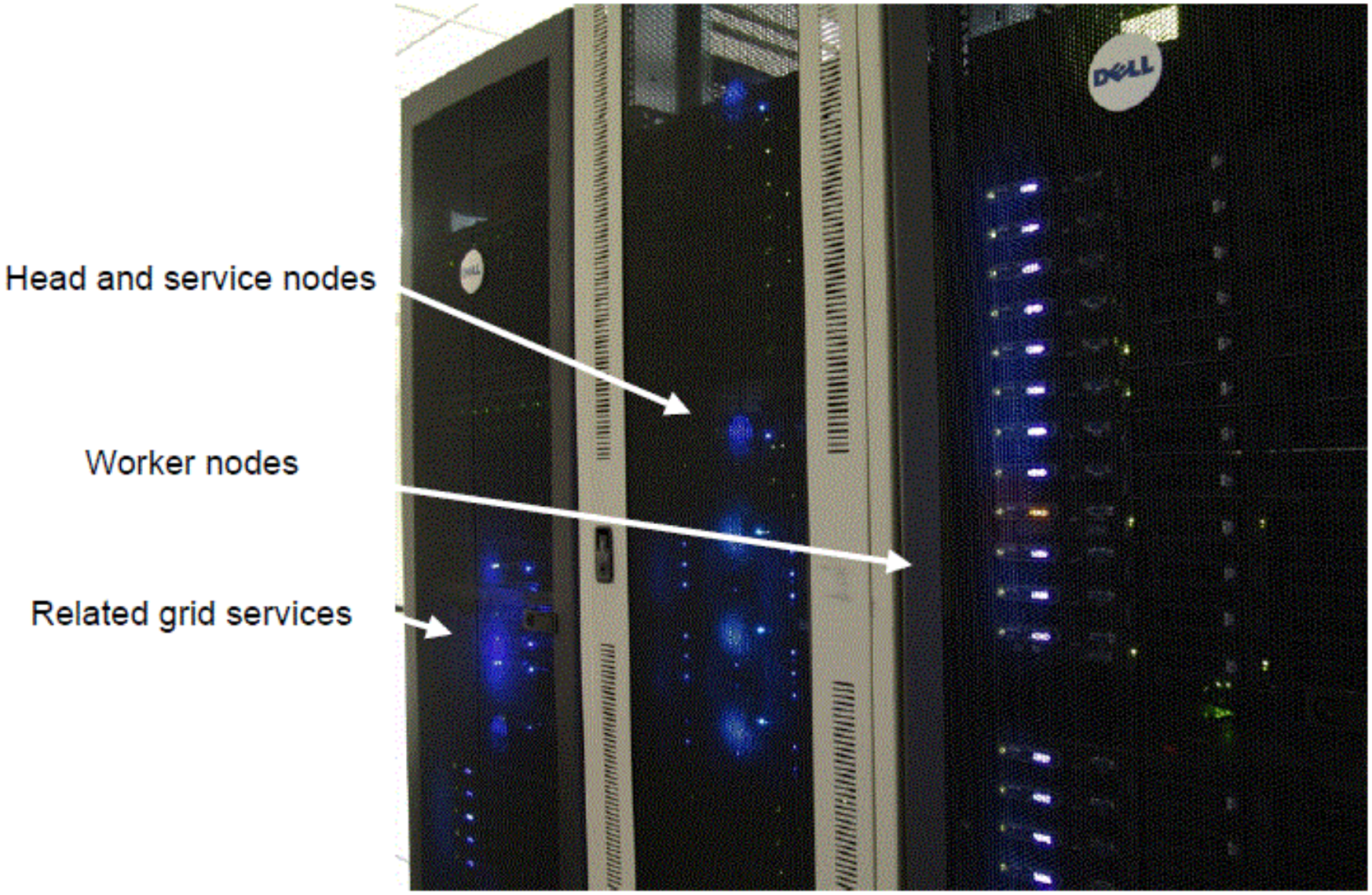
Special nodes

- **Hugin** – basic login node, Frontier Server , test queues for testing physicist
- **Munin** –basic login node, ITB storage element

Testwulf (ITB resource)

- Test Cluster
- 2 worker nodes

Antaeus Cluster



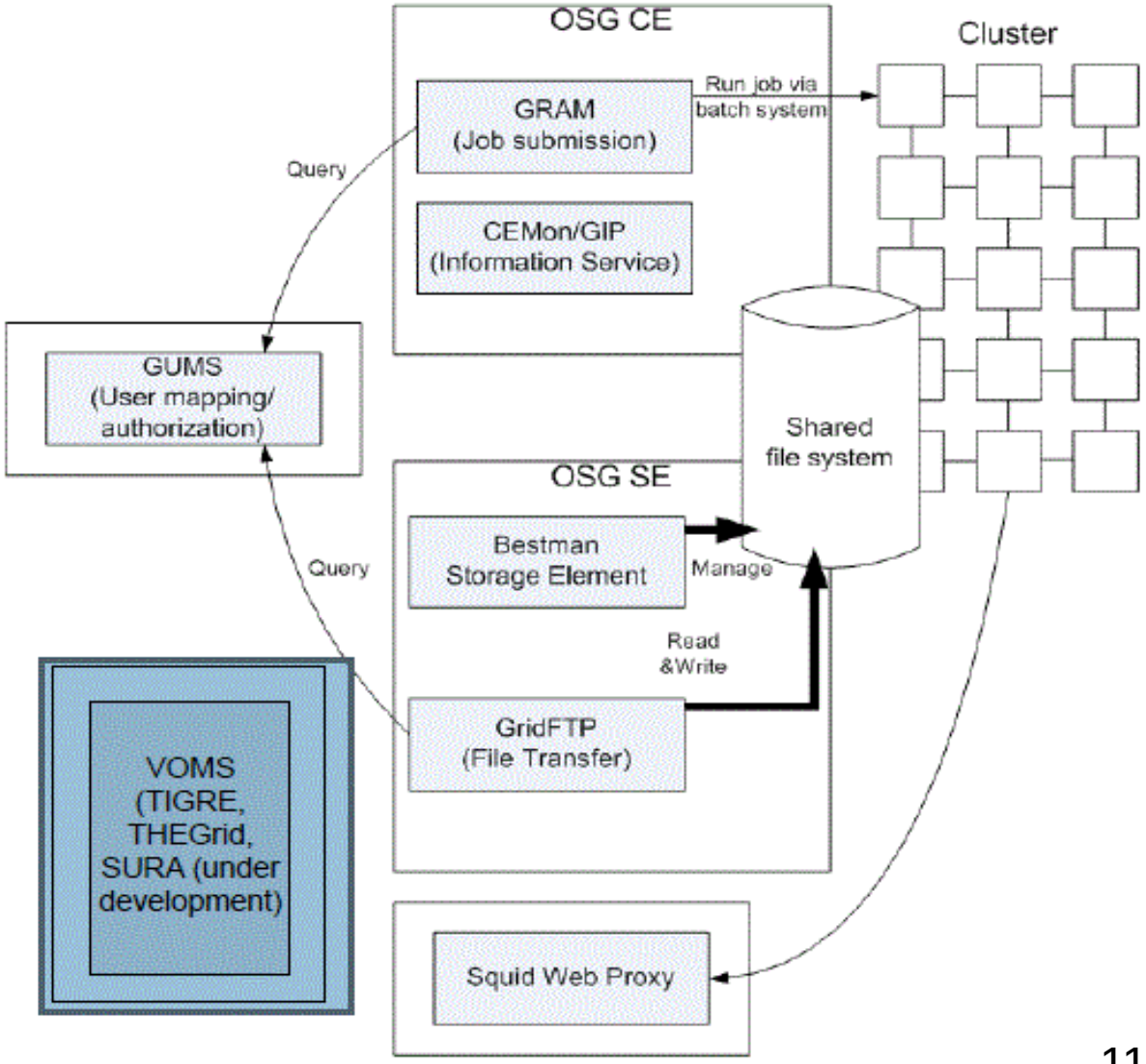
TTU Main Campus - HPCC Primary Linux Clusters

Grendel (primary parallel computing resource)

- Ranked 175 in the November 2009 Top 500 list, achieving 33.5 Teraflop/s max sustained and 40 Teraflop/s peak performance in LinPack test
- 420 dual slot quad core nodes with Intel(R) Xeon(R) CPU E5450 processors for a total of 3360 cores
- Each node has two Intel 5450 Quad Core 64 bit processors on a single board, as an SMP unit. Each node contains 16 GB of memory
- The core frequency is 3.0 GHz
- The core's are connected with DDR Infiniband, with a rating of 40.2 Tflop peak performance
- Interconnect: 4X DDR Non-Blocking InfiniBand
- A 80 TB Lustre file system runs over Infiniband
- HPCC website : http://www.hpcc.ttu.edu/

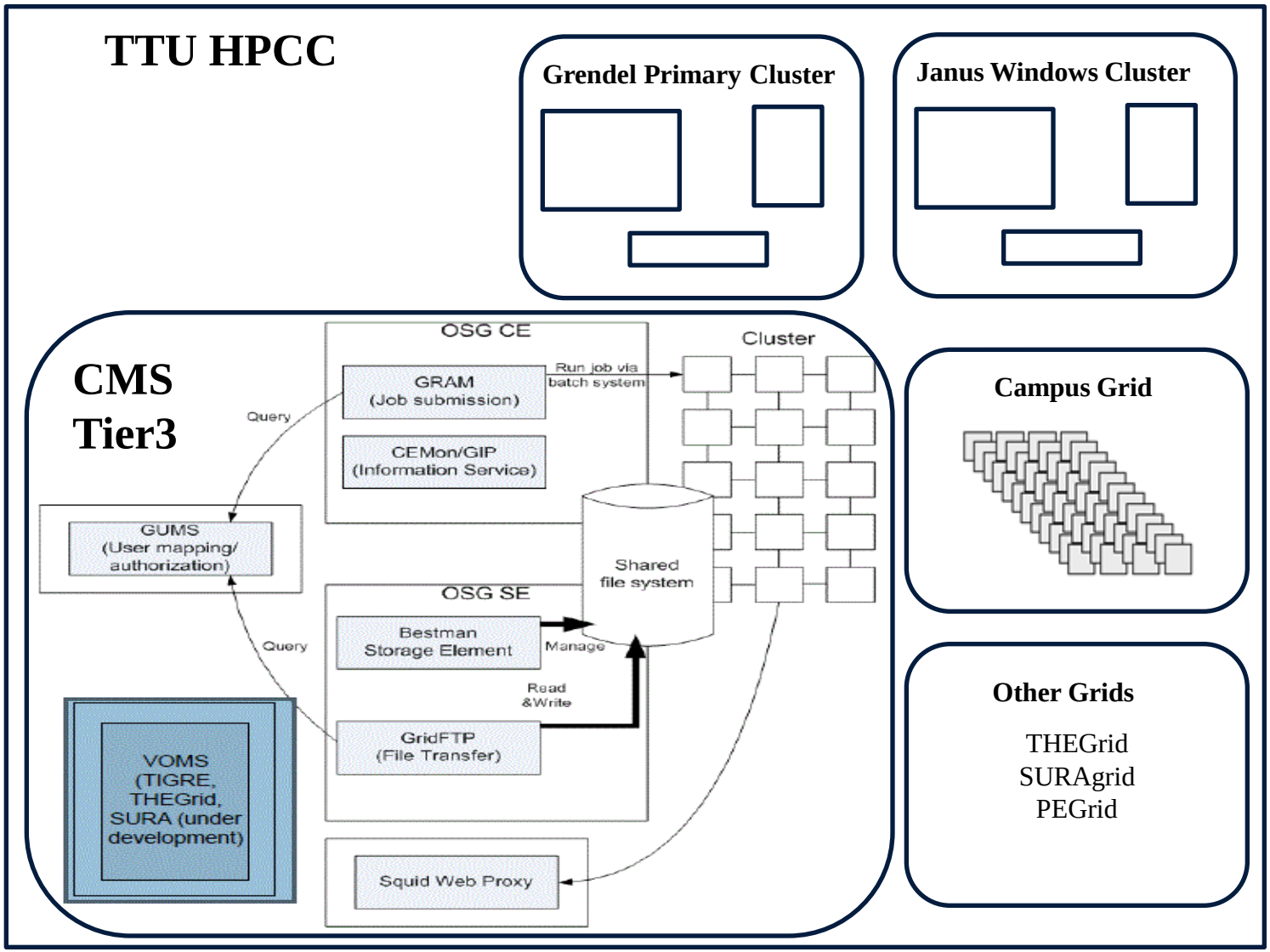
TTU Tier-3 site configuration

Basically the same as an OSG medium site, with additional services for other VOs



TTU Tier-3 site configuration

Our T3 exists and is supported in the context of other clusters in the TTU High Performance Computing Center



TTU Tier-3 Current Status and Capabilities

CPU power:

- Antaeus - Community Cluster – HEP, Chemistry group , HPCC
- Theoretically total 240 cores,
- HEP – 142 cores (two are down and out of warranty)

  - 128 Xeon cores available to cms queue + 16 cores interactive login (HEP group)
- Chemistry – 64 cores, HPCC – 32 cores

Storage:

- 261.4 TB dedicated HEP disk space, 6 TB general use
- PhEDEx production T3_US_TTU instance
- SRMv2 interface (BeStMan-2.2.1.3.13) to cluster storage

Software & Batch system:

- Rocks 5.3 based on CentosOS 5.4
- Oracle Grid Engine (previously known as Sun Grid Engine)

TTU Tier-3 installation methods

CE and worker node base grid software:

- OSG-1.2.11 on CE
- CMS software (CMSSW) is automatically installed
- Monitoring: SAM, Gratia, RSV, MonaLisa and Ganglia

GUMS (Grid Identity Mapping Service):

- OSG supplemented by TIGRE VO

VOMS (Virtual Organization Management Service):

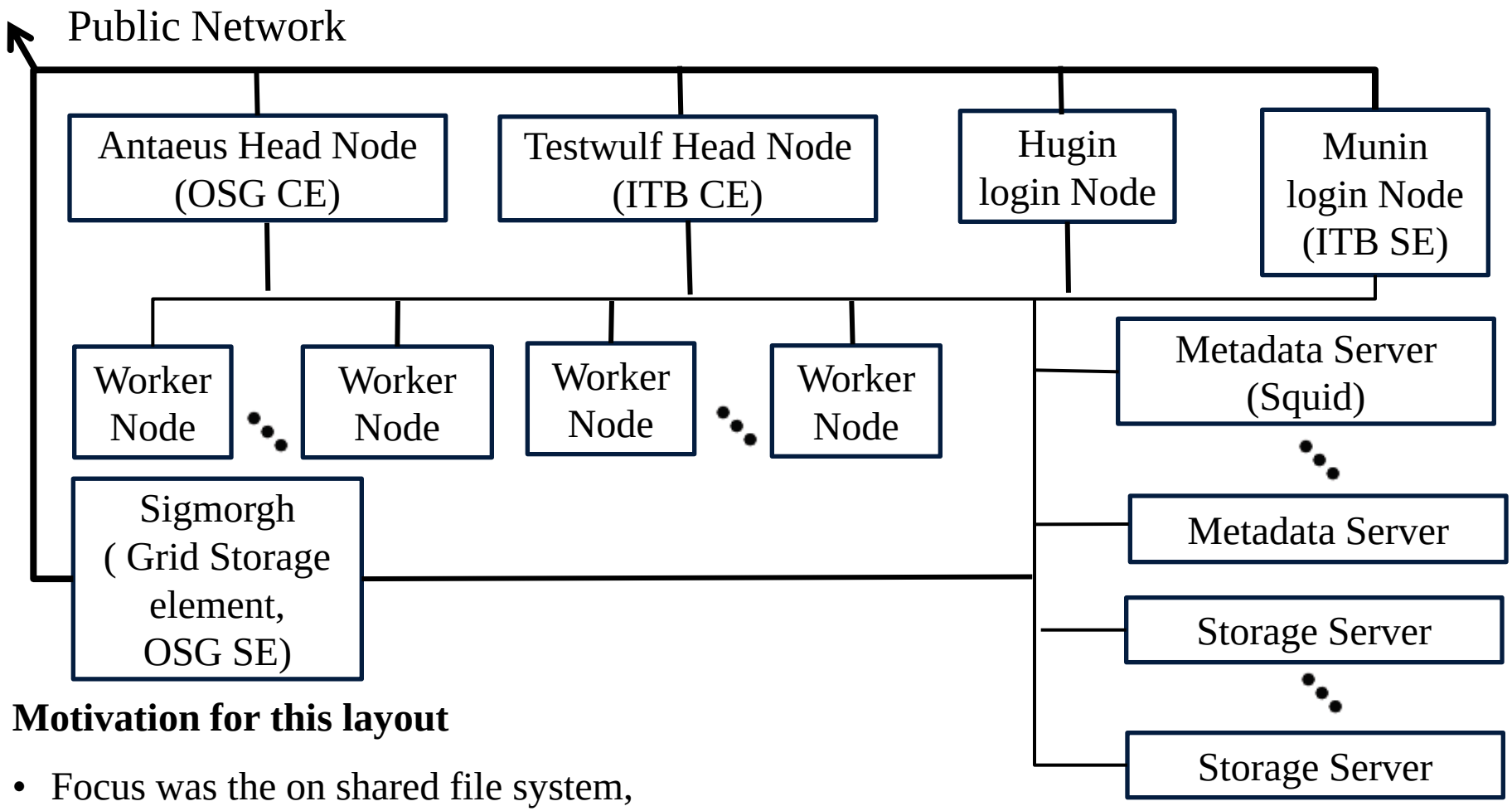
- Used to support TIGRE, THEGrid and SURA, PEGrid
- Prima authentication

FroNtier and squid

Storage (BeStMan)

Queues are set up for users, CMS jobs get priority over serial jobs, local users get priority over CMS users

Worker node and storage layout

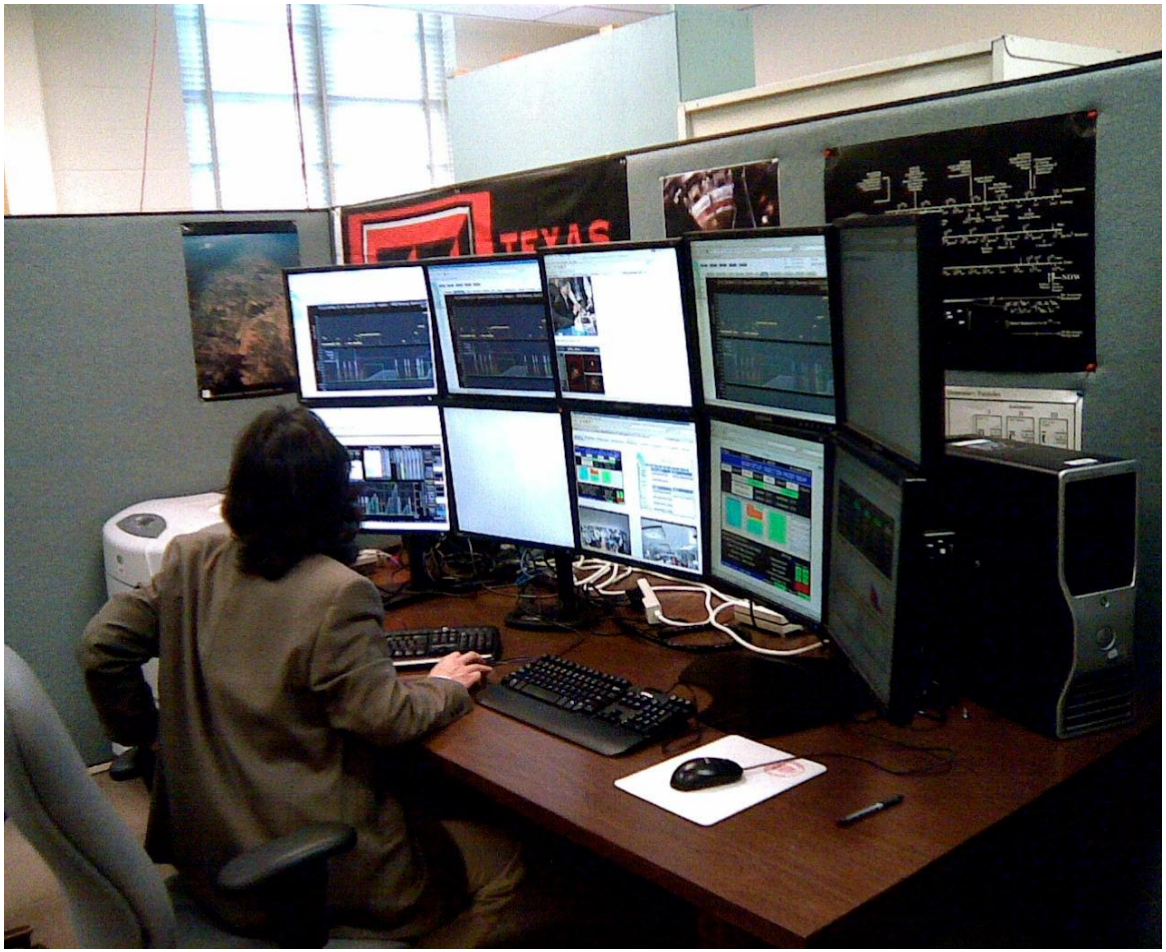


Motivation for this layout

- Focus was the on shared file system,
- No finances for separate ITB
- Avoided problems caused by over loading of NFS mounts

CMS center

- First CMS center outside Fermi Lab
- 12 monitor, two dual core system
- Official offline CSP CMS shifts
- Count towards requirement of CMS authorship



Way ahead

- Integrate - HEP office desktops with shared file system
- Use the Grendel's idle time to submit jobs as it is 20 times faster
- Virtualization – multiple copies of GUMS, Frontier db
- REDDnet (Research and Education Data Depot network) initiation
- Improve the CMS CSP facility

Current problems and general topics for discussion

- Queue advertisement

  - Control advertisement of queues to include only those available to grid users by VO, so that CMS jobs are not submitted to the wrong queues
  - Assign queues to our user groups over the other CMS groups
  - Blacklist/whitelist parameters in the config.ini script helped

- Grid jobs in general & CMS jobs, do not clean up after execution. What are the best practices ?

- If all the jobs occupy all the queues, there no room for monitoring jobs. Hence, monitoring jobs should run at high priorities

- Pilot jobs have increased from UCSD

  - violation of grid certificate usage
  - certificate is assigned to each pilot job instead of assigning it to a person