

# High Energy Physics at the OU Supercomputing Center for Education & Research

**Henry Neeman, Director**  
**OU Supercomputing Center for Education & Research**  
**University of Oklahoma**  
**D0SAR Workshop, Thursday September 21 2006**



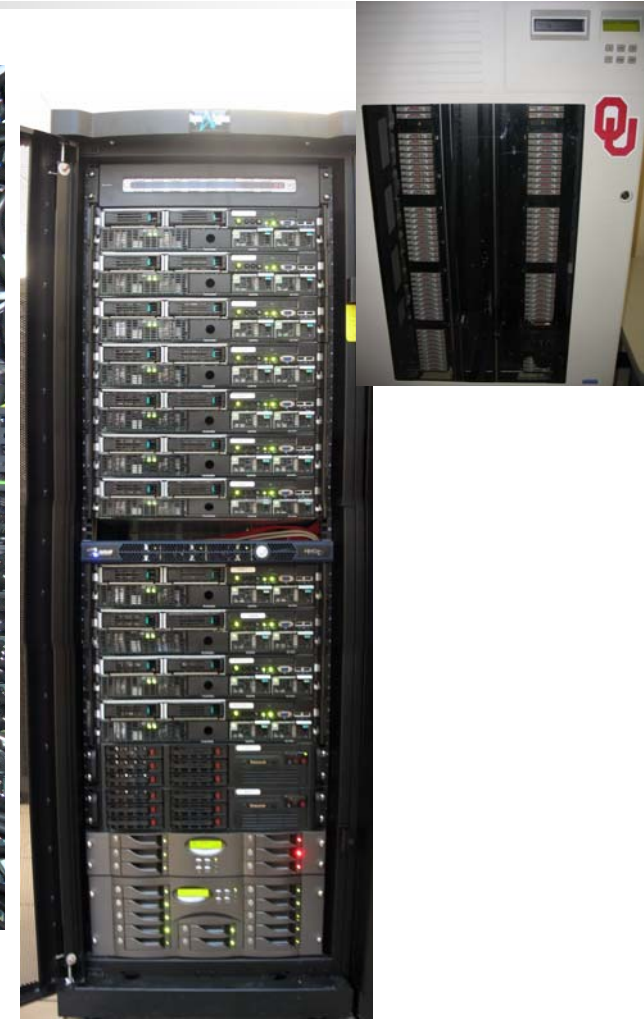
# People



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# Things



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# OSCER



# What is OSCER?

- Multidisciplinary center
- Division of OU Information Technology
- Provides:
  - Supercomputing education
  - Supercomputing expertise
  - Supercomputing resources: hardware, storage, software
- For:
  - Undergrad students
  - Grad students
  - Staff
  - Faculty
  - Their collaborators (including off campus)



# Who is OSCER? Academic Depts

- Aerospace & Mechanical Engr
- Anthropology
- Biochemistry & Molecular Biology
- Biological Survey
- Botany & Microbiology
- Chemical, Biological & Materials Engr
- Chemistry & Biochemistry
- Civil Engr & Environmental Science
- Computer Science
- Economics
- Electrical & Computer Engr
- Finance
- Health & Sport Sciences
- History of Science
- Industrial Engr
- Geography
- Geology & Geophysics
- Library & Information Studies
- Mathematics
- Meteorology
- Petroleum & Geological Engr
- **Physics & Astronomy**
- Radiological Sciences
- Surgery
- Zoology

**More than 150 faculty & staff** in **25 depts** in Colleges of Arts & Sciences, Business, Engineering, Geosciences and Medicine – with **more to come!**





# Who is OSCER? Organizations

- Advanced Center for Genome Technology
- Center for Analysis & Prediction of Storms
- Center for Aircraft & Systems/Support Infrastructure
- Cooperative Institute for Mesoscale Meteorological Studies
- Center for Engineering Optimization
- Fears Structural Engineering Laboratory
- Geosciences Computing Network
- Great Plains Network
- Human Technology Interaction Center
- Institute of Exploration & Development Geosciences
- Instructional Development Program
- Laboratory for Robotic Intelligence and Machine Learning
- **Langston University Mathematics Dept**
- Microarray Core Facility
- National Severe Storms Laboratory
- NOAA Storm Prediction Center
- OU Office of Information Technology
- OU Office of the VP for Research
- **Oklahoma Center for High Energy Physics**
- Oklahoma Climatological Survey
- Oklahoma EPSCoR
- Oklahoma Medical Research Foundation
- Oklahoma School of Science & Math
- St. Gregory's University Physics Dept
- Sarkeys Energy Center
- Sasaki Applied Meteorology Research Institute



# Biggest Consumers

- **Center for Analysis & Prediction of Storms:**  
daily real time weather forecasting 
- **Oklahoma Center for High Energy Physics:**  
simulation and data analysis of banging tiny particles together at unbelievably high speeds 
- **Advanced Center for Genome Technology:**  
bioinformatics (e.g., Human Genome Project)



# Who Are the Users?

**Over 300 users** so far:

- over 60 OU faculty
- over 60 OU staff
- **over 125 students**
- about 40 off campus users
- ... more being added every month.

**Comparison:** National Center for Supercomputing Applications (NCSA), after **20 years of history** and **hundreds of millions in expenditures**, has about **2100 users**.\*

\* Unique usernames on cu.ncsa.uiuc.edu and tungsten.ncsa.uiuc.edu



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# Okla. Supercomputing Symposium

**Join us Wed Oct 4 @ OU – FREE!**



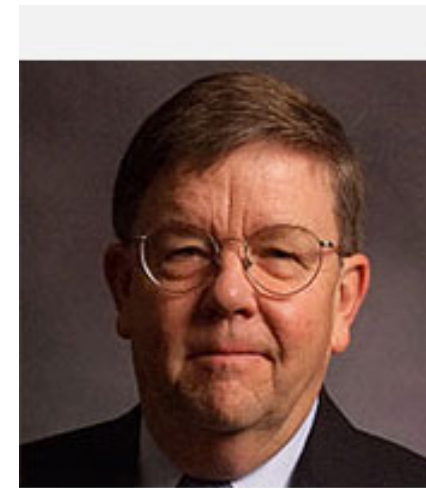
2003 Keynote:  
Peter Freeman  
NSF  
Computer &  
Information  
Science &  
Engineering  
Assistant Director



2004 Keynote:  
Sangtae Kim  
NSF Shared  
Cyberinfrastructure  
Division Director



2005 Keynote:  
Walt Brooks  
NASA Advanced  
Supercomputing  
Division Director

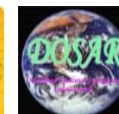


2006 Keynote:  
Dan Atkins  
Head of NSF's Office of  
Cyberinfrastructure

<http://symposium2006.oscer.ou.edu/>

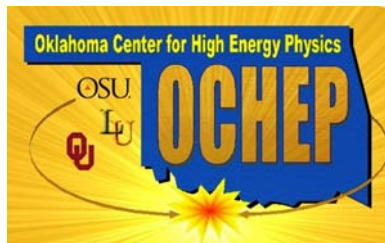


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# OSCER Resources

**An ORDER OF MAGNITUDE year!**





# 2005 OSCER Hardware

- **TOTAL:** 1484 GFLOPs\*, 368 CPUs, 434 GB RAM
- Aspen Systems Pentium4 Xeon 32-bit Linux Cluster
  - 270 Pentium4 Xeon CPUs, 270 GB RAM, 1.08 TFLOPs
- Aspen Systems Itanium2 cluster
  - 66 Itanium2 CPUs, 132 GB RAM, 264 GFLOPs
- IBM Regatta p690 Symmetric Multiprocessor
  - 32 POWER4 CPUs, 32 GB RAM, 140.8 GFLOPs
- IBM FAStT500 FiberChannel-1 Disk Server
- Qualstar TLS-412300 Tape Library

\* GFLOPs: billions of calculations per second



# 2006 OSCER Hardware

- **TOTAL:** 11,300 GFLOPs\*, 1838 CPUs, 3058 GB RAM
- **Dell Pentium4 Xeon 64-bit Linux Cluster**
  - 1024 Pentium4 Xeon CPUs, 2240 GB RAM, 6553 GFLOPs
- Aspen Systems Itanium2 cluster
  - 64 Itanium2 CPUs, 128 GB RAM, 256 GFLOPs
- **NEW! Condor Pool:** 750 student lab PCs, 4500 GFLOPs
- **NEW! National Lambda Rail** (10 Gbps network)
- **COMING! Small Opteron Cluster**
  - 16 AMD Opteron CPUs/32 cores, 128 GB RAM, 2500 GB disk
- **COMING! New tape library**

\* GFLOPs: billions of calculations per second



# Intel Xeon Linux Cluster

1,024 Intel Xeon CPUs (3.2 GHz)

2,176 GB RAM

14,000 GB disk

Infiniband & Gigabit Ethernet

OS: Red Hat Enterprise Linux 4

Peak speed: 6,553 GFLOPs\*

\*GFLOPs: billions of calculations per second

**DELL™**



`topdawg.oscer.ou.edu`



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# Intel Xeon Linux Cluster

**DEBUTED AT #54  
WORLDWIDE,  
#9 AMONG US  
UNIVERSITIES,  
#4 EXCLUDING BIG 3  
NSF CENTERS**

**CURRENTLY #88  
WORLDWIDE,  
#17 AMONG US  
UNIVERSITIES,  
#10 EXCLUDING BIG 3  
NSF CENTERS**

[www.top500.org](http://www.top500.org)

**DELL™**



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# Itanium2 Cluster

64 Itanium2 1.0 GHz CPUs  
128 GB RAM  
5,774 GB disk  
OS: Red Hat Linux  
Enterprise 4  
Peak speed: 256 GFLOPs\*  
\*GFLOPs: billions of  
calculations per second  
Purchased with NSF Major  
Research Instrumentation  
grant



[schooner.oscer.ou.edu](http://schooner.oscer.ou.edu)



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# Condor Pool

Condor is a software package that allows number crunching jobs to run on idle desktop PCs.

OU IT is deploying a large Condor pool (750 desktop PCs, almost 200 so far) over the course of the 2006.

When fully deployed, it'll provide a huge amount of additional computing power – more than was available in all of OSCER in 2005.

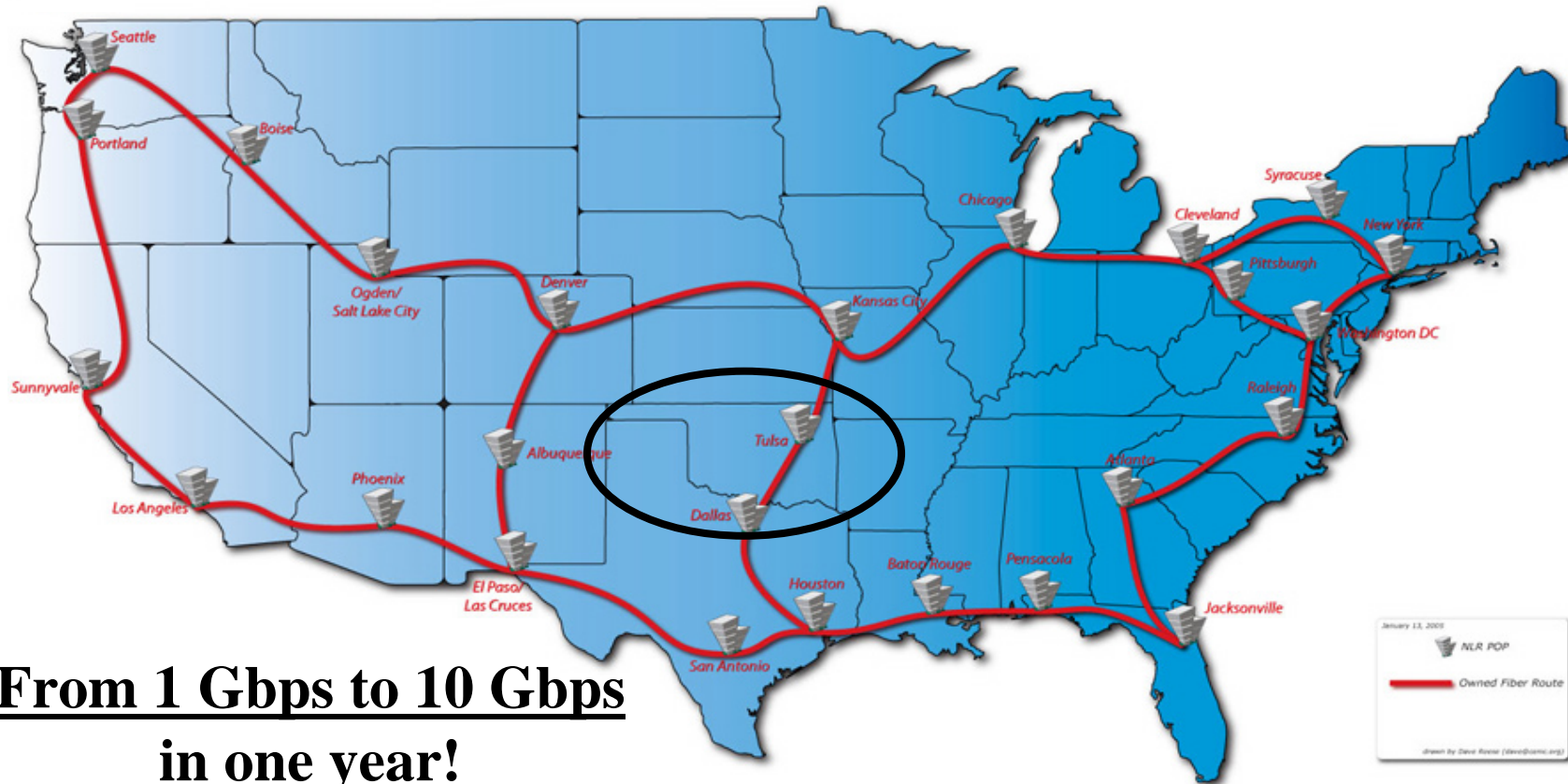
And, the cost is very very low.

Also, we've been seeing empirically that Condor gets about 90% of each PC's time.



# Coming! National Lambda Rail

The National Lambda Rail (NLR) is the next generation of high performance networking.



**From 1 Gbps to 10 Gbps  
in one year!**

© 2004 National LambdaRail

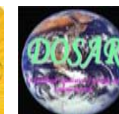
For more



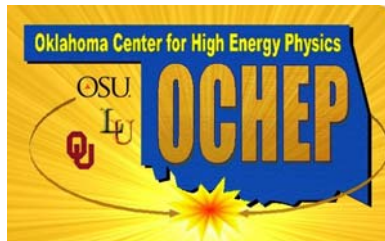
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# HEP @ OSCER





# HEP @ OSCER

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- HEP on OSCER's Linux cluster
- HEP on OSCER's Condor pool
- HEP on OSCER's grants



# HEP on OSCER's Linux Cluster

- Topdawg has a special grid services node set aside explicitly for HEP activities.
- The grid node is available only to HEP users.
- Horst Severini has pseudo-root privileges on it.
- It has its own disk space that's exclusively for HEP.
- HEP has its own queues, one for preemptable jobs and another for non-preemptable.
- We're expecting D0 to be up and running next week.





# HEP on OSCER's Condor Pool

- Samgrid is now running.
- Final certification in a few days.
- Currently almost 200 PCs but is expanding in the next few weeks to about 350.
- 750 PCs planned, but could become larger.



# HEP on OSCER's Grants

- NSF Major Research Instrumentation (\$504K)
  - PI Neeman, Co-PI Skubic (and others)
  - Purchased Itanium2 cluster
- NSF Small Grant for Exploratory Research (\$132K)
  - PI Neeman, Co-PI Severini
  - Using Condor to make large resources available for national emergencies
- NSF CI-TEAM (\$250K)
  - PI Neeman, Co-PI Severini (and others)
  - Teaching Condor use and management across the US





# To Learn More About OSCER

<http://www.oscer.ou.edu/>

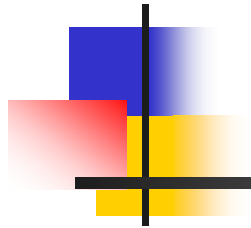


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**Thanks for your  
attention!**



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**Questions?**