OSCER: State of the Center

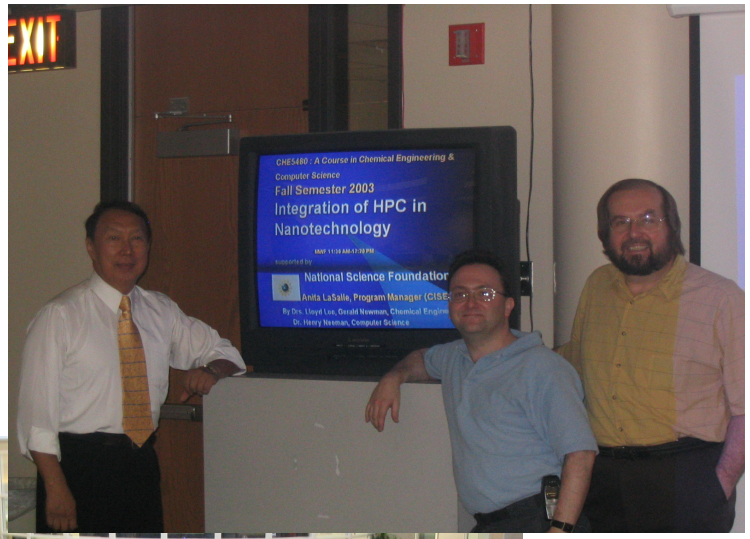
Henry Neeman, OSCER Director

hneeman@ou.edu

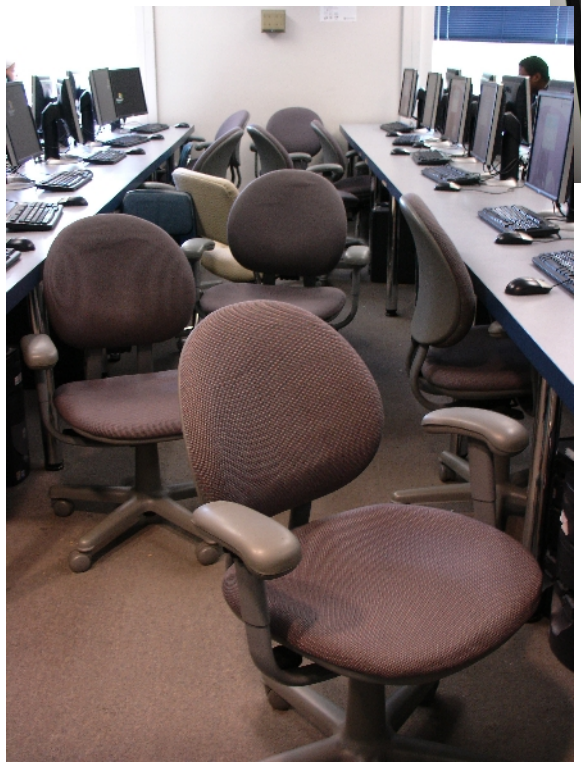
OU Supercomputing Center for Education & Research

Wednesday October 4 2006
University of Oklahoma

People


EXIT
CHE5480 : A Course in Chemical Engineering &
Computer Science
Fall Semester 2003
Integration of HPC in
Nanotechnology
National Science Foundation

Things



Outline

- Who, What, Where, When, Why, How
- What Does OSCER Do?
  - Resources – an **ORDER OF MAGNITUDE YEAR**
  - Education
  - Research
  - Dissemination
- OSCER's Future

OSCER:
Who, What, Where, When, Why, How

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
- 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 **24 depts** in Colleges of Arts & Sciences, Atmospheric & Geographic Sciences, Business, Earth & Energy, Engineering, 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
- **NEW! Interaction, Discovery, Exploration, Adaptation Laboratory**
- 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
- **Robotics, Evolution, Adaptation, and Learning Laboratory**
- St. Gregory's University Physics Dept
- Sarkeys Energy Center
- Sasaki Applied Meteorology Research Institute
- **NEW! Symbiotic Computing Laboratory**
- **YOU COULD BE HERE!**

Who is OSCER? Personnel

- Director: Henry Neeman
- Associate Director for Remote & Heterogeneous Computing: Horst Severini
- Manager of Operations: Brandon George
- System Administrator: David Akin (hired Jan 2005)
- System Administrator: Brett Zimmerman (hired July 2006) – **NEW!**

  (Hey, our operations staff doubles every three years!)
- Undergraduate Condor developer: Josh Alexander

Who is OSCER? Interns

OSCER has been attracting interns.

- **Library & Information Studies**: 1 student in fall 2003, 1 in fall 2004, 2 in spring 2005 (mostly working with OneNet)
- **French Universities**
  - 2005: 2 from Limoges, 1 from Claremont-Ferrand
  - 2006: 3 from Limoges, 10 from Claremont-Ferrand
  - **2007: 3 from Limoges, 3 from Claremont-Ferrand**
- **Independent Study**: typically 1 per semester

Who Are the Users?

Over 300 users so far, including:

- almost 50 OU faculty;
- over 50 OU staff;
- **over 100 students;**
- over 80 off campus users;
- … more being added every **week**.

Comparison: National Center for Supercomputing Applications (NCSA), after **20 years of history** and **hundreds of millions in expenditures**, has about **2150 users;*** the TeraGrid is 2550 users.†

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

† Unique usernames on maverick.tacc.utexas.edu

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)

Where is OSCER?

OU is building a new research campus.

The first building to open (March 29 2004), the **Stephenson Research & Technology Center** (SRTC), now houses bioinformatics, bioengineering, robotics and **OSCER**.

The **reception/poster session** was there last night.

Where is OSCER?

- OSCER's big Linux cluster is housed at the Merrick Computing Center, on OU's North Base, a few miles north of campus.

Why OSCER?

- Computational Science & Engineering has become **sophisticated enough** to take its place alongside experimentation and theory.
- **Most students** – and most faculty and staff – **don't learn much CSE**, because it's seen as needing too much computing background, and needs HPC, which is seen as very hard to learn.
- **HPC can be hard to learn**: few materials for novices; most documents written for experts as reference guides.
- **We need a new approach**: HPC and CSE for computing novices – **OSCER's mandate!**

Why Bother Teaching Novices?

- Application scientists & engineers typically know their applications very well, much better than a collaborating computer scientist ever would.
- Commercial software lags far behind the research community.
- Many potential CSE users don't need full time CSE and HPC staff, just some help.
- One HPC expert can help dozens of research groups.
- Today's novices are tomorrow's top researchers, especially because today's top researchers will eventually retire.

What Does OSCER Do?

What Does OSCER Do?

- Resources – **ORDER OF MAGNITUDE YEAR**
- Teaching
- Research
- Dissemination

OSCER Resources

An ORDER OF MAGNITUDE year!

2005 OSCER Hardware

- **TOTAL:** 1477 GFLOPs*, 366 CPUs, 430 GB RAM
- Aspen Systems Pentium4 Xeon 32-bit Linux Cluster
  - 270 Pentium4 Xeon CPUs, 270 GB RAM, 1.08 TFLOPs
- Aspen Systems Itanium2 cluster
  - 64 Itanium2 CPUs, 128 GB RAM, 256 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, 3054 GB RAM
- **Dell Pentium4 Xeon 64-bit Linux Cluster**
  - 1024 Pentium4 Xeon CPUs, 2176 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 Shared Memory Cluster**
- **COMING! New storage library**

* GFLOPs: billions of calculations per second

Intel Xeon Linux Cluster

1,024 Intel Xeon CPUs (3.2 GHz)
2,176 GB RAM
23,000 GB disk
Cisco SystemsInfiniband
Force10 Networks Gigabit Ethernet
Red Hat Enterprise Linux 4
Peak speed: 6,553 GFLOPs*
*GFLOPs: billions of calculations per second

topdawg.oscer.ou.edu

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

topdawg.oscer.ou.edu

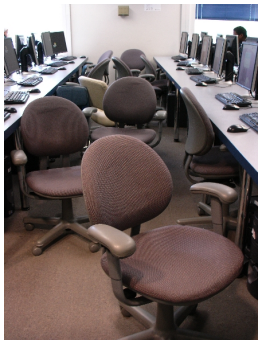
Itanium2 Cluster

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

Aspen Systems Inc.

schooner.oscer.ou.edu

NEW! 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) over the course of the 2006.

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

And, the cost is very very low.

Also, we've been seeing empirically that Condor gets about 80% of each PC's time.

What is Condor?

Condor is **grid computing** technology:

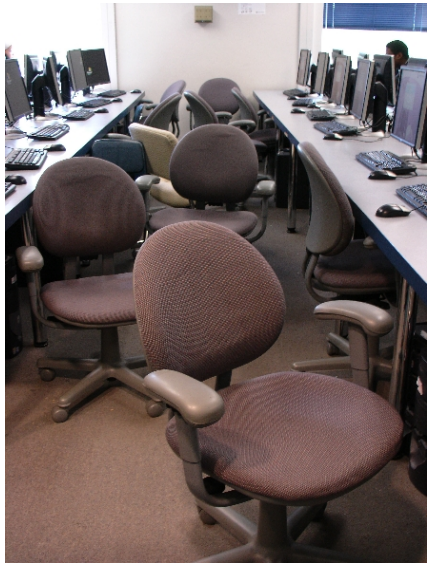
- it **steals compute cycles** from existing desktop PCs;
- it **runs in background** when no one is logged in.

Condor is like SETI@home, but **better**:

- it's **general purpose** and can work for any **"loosely coupled"** application;
- it can do all of its **I/O over the network**, not using the desktop PC's disk.

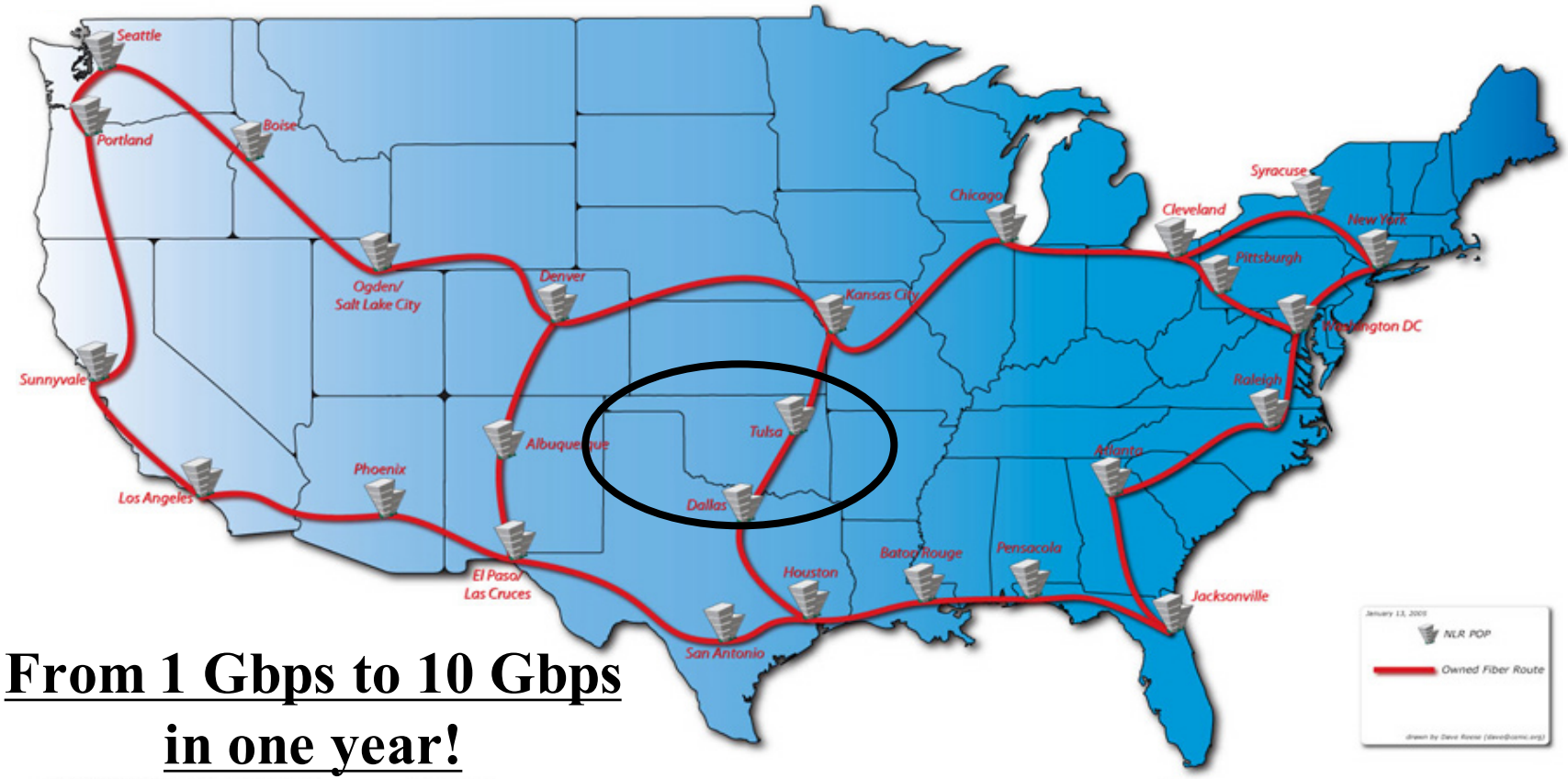
Current Status at OU

- Pool of almost 200 machines in OU IT PC labs
- Submit/management from Neeman's desktop PC
- Already being used/tested
- Rollout to additional labs during fall
- Total rollout to 750 PCs by Xmas 2006
- **COMING:** 2 submit nodes, large RAID, 2 management nodes



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!

2002 Machines Decommissioned in 2006

- Linux Cluster (`boomer.oscer.ou.edu`)
  - 270 2 GHz CPUs
  - 270 GB RAM
  - ~10,000 GB disk
  - 1080 GFLOPs*
- IBM p690 (`sooner.oscer.ou.edu`)
  - 32 1.1 GHz CPUs
  - 32 GB RAM
  - 140.8 GFLOPs*
- IBM FAStT500 (disk server for sooner): ~2000 GB

Dead Supercomputer Club

FAStT500
disk server

boomer.oscer.ou.edu sooner.oscer.ou.edu

Dead Supercomputer Club

FAStT500
disk server

boomer.oscer.ou.edu sooner.oscer.ou.edu

Dead Supercomputer Club

FAStT500
disk server

boomer.oscer.ou.edu sooner.oscer.ou.edu

Dead Supercomputer Club

FAStT500
disk server

boomer.oscer.ou.edu sooner.oscer.ou.edu

Dead Supercomputer Club

http://www.cp-tel.net/pasqualy/kingmole/242F.jpg

OSCER Teaching

What Does OSCER Do? Teaching

Science and engineering faculty from all over America learn supercomputing at OU by playing with a jigsaw puzzle (NCSI @ OU 2004).

What Does OSCER Do? Rounds

OU undergrads, grad students, staff and faculty learn how to use supercomputing in their specific research.

OSCER's Education Strategy

- "Supercomputing in Plain English" workshops
- Supercomputing tours (like last night)
- Q&A
- Rounds

Supercomputing in Plain English

Supercomputing in Plain English workshops target not only people who are sophisticated about computing, but especially students and researchers with strong science or engineering backgrounds but modest computing experience.

Prerequisite: 1 semester of Fortran, C, C++ or Java

Taught by analogy, storytelling and play, with minimal use of jargon, and assuming very little computing background.

Streaming video:

`http://www.oscer.ou.edu/education.php`

Registrations: almost 200 from 2001 to 2004

Workshop Topics

- Overview
- The Storage Hierarchy
- Instruction Level Parallelism
- High Performance Compilers
- Shared Memory Parallelism
- Distributed Parallelism
- Grab Bag: Scientific Libraries, I/O libraries, Visualization

Teaching: Workshops

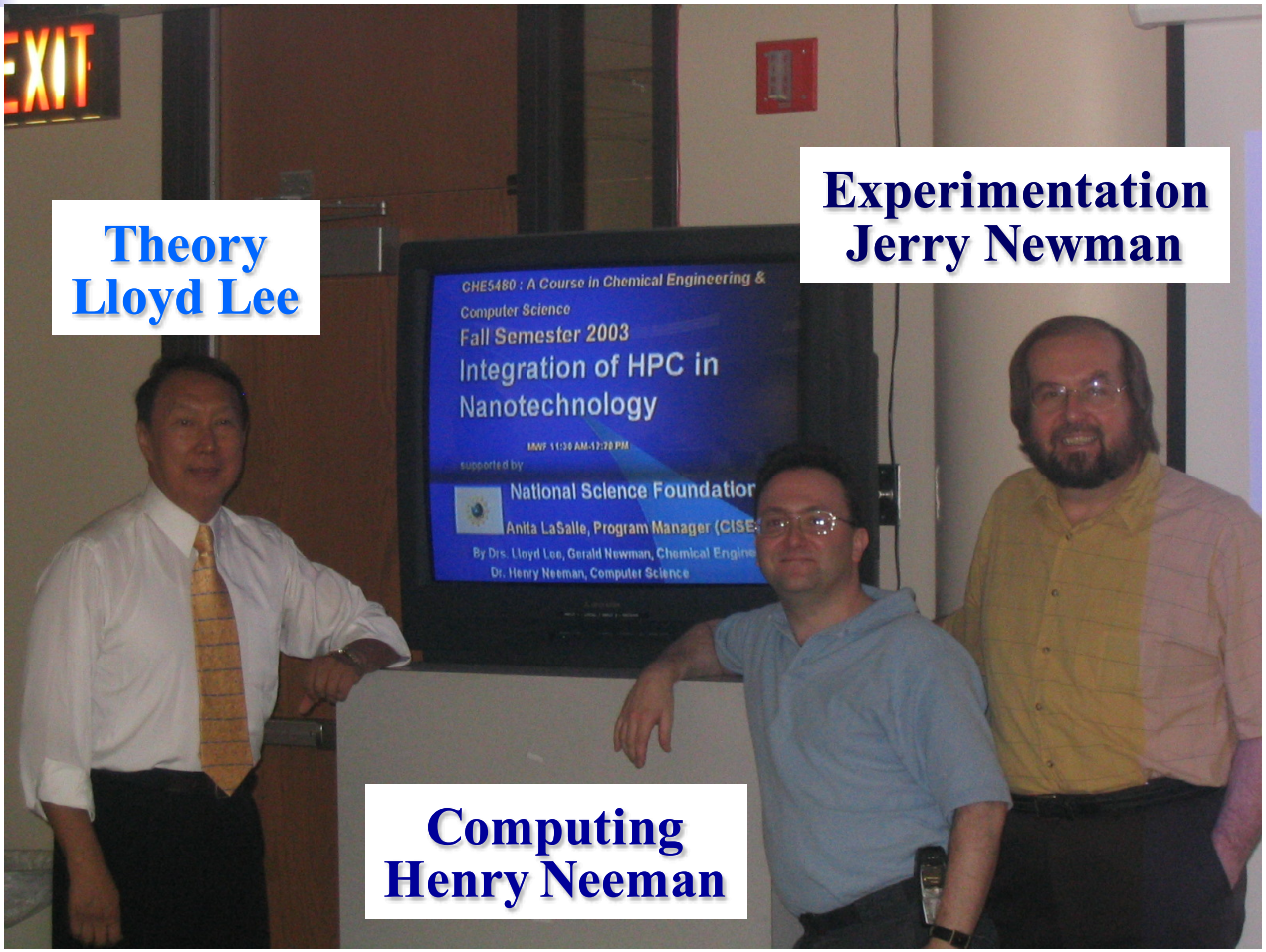
- Supercomputing in Plain English
  - Fall 2001: 87 registered, 40 – 60 attended each time
  - Fall 2002: 66 registered, c. 30 – 60 attended each time
  - Fall 2004: 47 registered, c. 30-40 attend each time
- NCSI Parallel & Cluster Computing workshop (Aug 8-14 2004)
- Linux Clusters Institute workshop (June 2005)
- NCSI Parallel & Cluster Computing workshop (summer 2005)
- **NEW! Taught at NCSI Parallel & Cluster Computing workshop (May 2006) at Houston Community College**
- **COMING! Linux Clusters Institute workshop (Feb 2007)**

… and more to come.

Teaching: Academic Coursework

- CS: Scientific Computing (S. Lakshmivarahan)
- CS: Computer Networks & Distributed Processing (S. Lakshmivarahan)
- Meteorology: Computational Fluid Dynamics (M. Xue)
- Chemistry: Molecular Modeling (R. Wheeler)
- Electrical Engr: Computational Bioengineering (T. Ibrahim)
- Chem Engr: Nanotechnology & HPC (L. Lee, G. Newman, H. Neeman)

OU Nano/HPC Teaching Team



Putting together theory, computing and experimentation in a single engineering course (nanotechnology)

(taught fall 2003, summer 2005, 22 students total)

Teaching: Presentations & Tours

- Courses at OU
  - Chem Engr: Industrial & Environmental Transport Processes (D. Papavassiliou)
  - Engineering Numerical Methods (U. Nollert)
  - Math: Advanced Numerical Methods (R. Landes)
  - Electrical Engr: Computational Bioengineering (T. Ibrahim)
- Research Experience for Undergraduates at OU
  - Ind Engr: Metrology REU (T. Reed Rhoads)
  - Ind Engr: Human Technology Interaction Center REU (R. Shehab)
  - Meteorology REU (D. Zaras)
- External
  - American Society of Mechanical Engineers, OKC Chapter
  - Oklahoma State Chamber of Commerce
  - **NEW! National Educational Computing Conference 2006 (virtual tour via videoconference)**

- Other Universities
  1. SUNY Binghamton (NY)
  2. **NEW! Bradley University (IL)**
  3. Cameron University (OK)
  4. **NEW! El Bosque University (Colombia)**
  5. **NEW! Southwestern University (TX)**
  6. Louisiana State University
  7. **NEW! Midwestern State University (TX)**
  8. Northwestern Oklahoma State University
  9. Oklahoma Baptist University
  10. **NEW! Oklahoma City University**
  11. Oklahoma State University - OKC
  12. St. Gregory's University (OK)
  13. **NEW! Southeastern Oklahoma State University (TORUS)**
  14. **NEW! University of Arkansas at Little Rock**
  15. University of Central Oklahoma
- High Schools and High School Programs
  - Oklahoma School of Science & Mathematics
  - Oklahoma Christian University's Opportunity Bytes Summer Academy
  - Dept of Energy National Scholarship Finalists
  - **NEW! Ardmore High School (OK)**

Teaching: Q & A

OSCER has added a new element to our education program:

When students take the Supercomputing in Plain English workshops, they then are required to ask 3 questions per person per video.

Dr. Neeman meets with them in groups to discuss these questions.

Result: A much better understanding of supercomputing.

What Does OSCER Do? Rounds

OU undergrads, grad students, staff and faculty learn how to use supercomputing in their specific research.

Research & Teaching: Rounds

Rounds: interacting regularly with several research groups

- **Brainstorm** ideas for applying supercomputing to the group's research
- **Code**: design, develop, debug, test, benchmark
- **Learn** new computing environments
- **Write** papers and posters

Has now evolved into **supercomputing help sessions**, where many different groups work at the same time.

Teaching: Rounds Ride-Alongs

Ride-alongs: students in CS 1313 (Programming for Non-majors) get extra credit for **taking the supercomputing tour** and **"riding along"** on a round: a **"living lab"** of scientists & engineers in their native habitat.

- Library & Information Studies: on-campus internships
- History of Science: like CS students

OSCER Research

OSCER Research

- OSCER's Approach
- Rounds
- Grants
- Upcoming Initiatives

What Does OSCER Do? Rounds

OU undergrads, grad students, staff and faculty learn how to use supercomputing in their specific research.

Research: OSCER's Approach

- **Typically**, supercomputing centers provide resources and have in-house application groups, but **most users are more or less on their own**.
- OSCER's approach is **unique**: we **partner directly** with research teams, providing supercomputing expertise to help their research move forward faster (**rounds**).
- This way, OSCER has a stake in each team's success, and each team has a stake in OSCER's success.

Research & Teaching: Rounds

Rounds: interacting regularly with several research groups

- **Brainstorm** ideas for applying supercomputing to the group's research
- **Code**: design, develop, debug, test, benchmark
- **Learn** new computing environments
- **Write** papers and posters

Has now evolved into **supercomputing help sessions**, where many different groups work at the same time.

Research: Grant Proposals

- OSCER provides text not only about resources but especially about education and research efforts (workshops, rounds, etc).
- Faculty write in small amount of money for:
  - funding of small pieces of OSCER personnel;
  - storage (disk, tape);
  - special purpose software.
- In many cases, OSCER works with faculty on developing and preparing proposals.
- OSCER has a **line item** in the OU proposal web form that all new proposals have to fill out.

External Research Grants

- K. Droegemeier et al., "Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere," NSF, $17M (total), $5.6M (OU)
- K. Droegemeier et al., "Linked Environments for Atmospheric Discovery (LEAD)," NSF, $11.25M (total), $2.5M (OU)
- M. Strauss, P. Skubic et al., "Oklahoma Center for High Energy Physics", DOE EPSCoR, $3.4M (total), $1.6M (OU)
- M. Richman, A. White, V. Lakshmanan, V. DeBrunner, P. Skubic, "Real Time Mining of Integrated Weather Data," NSF, $950K
- D. Weber, K. Droegemeier, H. Neeman, "Modeling Environment for Atmospheric Discovery," NCSA, $435K
- H. Neeman, K. Droegemeier, K. Mish, D. Papavassiliou, P. Skubic, "Acquisition of an Itanium Cluster for Grid Computing," NSF, $340K
- J. Levit, D. Ebert (Purdue), C. Hansen (U Utah), "Advanced Weather Data Visualization," NSF, $300K
- L. Lee, J. Mullen (Worcester Polytechnic), H. Neeman, G.K. Newman, "Integration of High Performance Computing in Nanotechnology," NSF, $400K
- R. Wheeler, "Principal mode analysis and its application to polypeptide vibrations," NSF, $385K
- R. Kolar, J. Antonio, S. Dhall, S. Lakshmivarahan, "A Parallel, Baroclinic 3D Shallow Water Model," DoD - DEPSCoR (via ONR), $312K
- D. Papavassiliou, "Turbulent Transport in Wall Turbulence," NSF, $165K
- D. Papavassiliou, M. Zaman, H. Neeman, "Integrated, Scalable MBS for Flow Through Porous Media," NSF, $150K
- Y. Wang, P. Mukherjee, "Wavelet based analysis of WMAP data," NASA, $150K

OSCER-RELATED FUNDING TO DATE: $54M total, $30.7M to OU

External Research Grants (cont'd)

- E. Mansell, C. L. Ziegler, J. M. Straka, D. R. MacGorman, "Numerical modeling studies of storm electrification and lightning," $605K
- K. Brewster, J. Gao, F. Carr, W. Lapenta, G. Jedlovec, "Impact of the Assimilation of AIRS Soundings and AMSR-E Rainfall on Short Term Forecasts of Mesoscale Weather," NASA, $458K
- R. Wheeler, T. Click, "National Institutes of Health/Predoctoral Fellowships for Students with Disabilties," NIH/NIGMS, $80K
- K. Pathasarathy, D. Papavassiliou, L. Lee, G. Newman, "Drag reduction using surface-attached polymer chains and nanotubes," ONR, $730K
- D. Papavassiliou, "Turbulent transport in non-homogeneous turbulence, " NSF, $320K
- C. Doswell, D. Weber, H. Neeman, "A Study of Moist Deep Convection: Generation of Multiple Updrafts in Association with Mesoscale Forcing," NSF, $430K
- D. Papavassiliou, "Melt-Blowing: Advance modeling and experimental verification," NSF, $321K
- R. Kol,ar et al., "A Coupled Hydrodynamic/Hydrologic Model with Adaptive Gridding," ONR, $595K
- M. Xue, F. Carr, A. Shapiro, K. Brewster, J. Gao, "Research on Optimal Utilization and Impact of Water Vapor and Other High Resolution Observations in Storm-Scale QPF," NSF, $880K.
- J. Gao, K. Droegemeier, M. Xue, "On the Optimal Use of WSR-88D Doppler Radar Data for Variational Storm-Scale Data Assimilation," NSF, $600K.
- K. Mish, K. Muraleetharan, "Computational Modeling of Blast Loading on Bridges," OTC, $125K
- V. DeBrunner, L. DeBrunner, D. Baldwin, K. Mish, "Intelligent Bridge System," FHWA, $3M
- D. Papavassiliou, "Scalar Transport in Porous Media," ACS-PRF, $80K
- Y. Wang, P. Mukherjee, "Wavelet based analysis of WMAP data," NASA, $150K
- R. Wheeler et al., "Testing new methods for structure prediction and free energy calculations (Predoctoral Fellowship for Students with Disabilities)," NIH/NIGMS, $24K
- L. White et al., "Modeling Studies in the Duke Forest Free-Air CO2 Enrichment (FACE) Program," DOE, $730K

External Research Grants (NEW!)

- Neeman, Severini, "Cyberinfrastructure for Distributed Rapid Response to National Emergencies", NSF, $132K
- Neeman, Roe, Severini, Wu et al., "Cyberinfrastructure Education for Bioinformatics and Beyond," NSF, $250K
- K. Milton, C. Kao, "Non-perturbative Quantum Field Theory and Particle Theory Beyond the Standard Model," DOE, $150K
- J. Snow, "Oklahoma Center for High Energy Physics", DOE EPSCoR, $3.4M (total), $169K (LU)
- J. Snow, "Langston University High Energy Physics," $155K (LU)
- M. Xue, F. Kong, "OSSE Experiments for airborne weather sensors," Boeing, $90K
- M. Xue, K. Brewster, J. Gao, A. Shapiro, "Storm-Scale Quantitative Precipitation Forecasting Using Advanced Data Assimilation Techniques: Methods, Impacts and Sensitivities," NSF, $835K
- Y. Kogan, D. Mechem, "Improvement in the cloud physics formulation in the U.S. Navy Coupled Ocean-Atmosphere Mesoscale Prediction System," ONR, $889K
- G. Zhang, M. Xue, P. Chilson, T. Schuur, "Improving Microphysics Parameterizations and Quantitative Precipitation Forecast through Optimal Use of Video Disdrometer, Profiler and Polarimetric Radar Observations," NSF, $464K
- T. Yu, M. Xue, M. Yeay, R. Palmer, S. Torres, M. Biggerstaff, "Meteorological Studies with the Phased Array Weather Radar and Data Assimilation using the Ensemble Kalman Filter," ONR/Defense EPSCOR/OK State Regents, $560K
- B. Wanner, T. Conway, et al., "Development of the www.EcoliCommunity.org Information Resource," NIH, $1.5M (total), $150K (OU)
- T. Ibrahim et al., "A Demonstration of Low-Cost Reliable Wireless Sensor for Health Monitoring of a Precast Prestressed Concrete Bridge Girder," OK Transportation Center, $80K
- T. Ibrahim et al., "Micro-Neural Interface," OCAST, $135K

External Research Grants (NEW!)

- L.M. Leslie, M.B. Richman, C. Doswell, "Detecting Synoptic-Scale Precursors Tornado Outbreaks," NSF, $548K
- L.M. Leslie, M.B. Richman, "Use of Kernel Methods in Data Selection and Thinning for Satellite Data Assimilation in NWP Models," NOAA, $342K
- P. Skubic, M. Strauss, et al., "Experimental Physics Investigations Using Colliding Beam Detectors at Fermilab and the LHC," DOE, $503K
- E. Chesnokov, "Fracture Prediction Methodology Based On Surface Seismic Data," Devon Energy, $1M
- E. Chesnokov, "Scenario of Fracture Event Development in the Barnett Shale (Laboratory Measurements and Theoretical Investigation)," Devon Energy, $1.3M
- A. Fagg, "Development of a Bidirectional CNS Interface or Robotic Control," NIH, $600K

NEW! NSF CI-TEAM Grant

"Cyberinfrastructure Education for Bioinformatics and Beyond" ($250,000)

OSCER recently received a grant from the National Science Foundation's Cyberinfrastructure Training, Education, Advancement, and Mentoring for Our 21st Century Workforce (CI-TEAM) program.

NEW! NSF CI-TEAM Grant

"Cyberinfrastructure Education for Bioinformatics and Beyond" ($250,000)

Objectives:

- Provide Condor resources to the national community
- Teach users to use Condor
- Teach sysadmins to deploy and administer Condor
- Teach bioinformatics students to use BLAST on Condor

NEW! NSF CI-TEAM Grant

Participants at OU (29 faculty/staff in 16 depts)

- Information Technology
  - OSCER: Neeman (PI)
- College of Arts & Sciences
  - Botany & Microbiology: Conway, Wren
  - Chemistry & Biochemistry: Roe (Co-PI), Wheeler
  - Mathematics: White
  - Physics & Astronomy: Kao, Severini (Co-PI), Skubic, Strauss
  - Zoology: Ray
- College of Earth & Energy
  - Sarkeys Energy Center: Chesnokov
- College of Engineering
  - Aerospace & Mechanical Engr: Striz
  - Chemical, Biological & Materials Engr: Papavassiliou
  - Civil Engr & Environmental Science: Vieux
  - Computer Science: Dhall, Fagg, Hougen, Lakshmivarahan, McGovern, Radhakrishnan
  - Electrical & Computer Engr: Cruz, Todd, Yeary, Yu
  - Industrial Engr: Trafalis
- Health Sciences Center
  - Biochemistry & Molecular Biology: Zlotnick
  - Radiological Sciences: Wu (Co-PI)
  - Surgery: Gusev

Participants at other institutions (19 faculty/staff at 14 institutions)

- California State U Pomona (masters-granting, minority serving): Lee
- Contra Costa College (2-year, minority serving): Murphy
- Earlham College (4-year): Peck
- Emporia State U (masters-granting): Pheatt, Ballester
- Kansas State U: Andresen, Monaco
- Langston U (masters-granting, minority serving): Snow
- Oklahoma Baptist U (4-year): Chen, Jett, Jordan
- Oklahoma School of Science & Mathematics (high school): Samadzadeh
- St. Gregory's U (4-year): Meyer
- U Arkansas: Apon
- U Central Oklahoma (masters-granting): Lemley, Wilson
- U Kansas: Bishop
- U Nebraska-Lincoln: Swanson
- U Northern Iowa (masters-granting): Gray

NEW! NSF CI-TEAM Grant

"Cyberinfrastructure Education for Bioinformatics and Beyond" ($250,000)

OSCER will be presenting the "Supercomputing in Plain English" workshops over videoconferencing in Spring 2007.

INTERESTED? Contact Henry (hneeman@ou.edu)

NEW! NSF CI-TEAM Grant

"Cyberinfrastructure Education for Bioinformatics and Beyond" ($250,000)

OSCER will be proving supercomputing rounds via videoconferencing starting in Spring 2007.

INTERESTED? Contact Henry (hneeman@ou.edu)

NEW! NSF CI-TEAM Grant

"Cyberinfrastructure Education for Bioinformatics and Beyond" ($250,000)

OSCER will be producing drop-in CDs for installing Linux-enabled Condor inside a Windows PC.

INTERESTED? Contact Henry (hneeman@ou.edu)

NEW! NSF CI-TEAM Grant

"Cyberinfrastructure Education for Bioinformatics and Beyond" ($250,000)

OSCER will be providing help on installing Linux as the native host OS, VMware, Windows as the desktop OS, and Condor running inside Linux.

INTERESTED? Contact Henry (hneeman@ou.edu)

NEW! NSF SGER Grant

In Nov 2005, OSCER was awarded a National Science Foundation Small Grant for Exploratory Research (SGER):

"Cyberinfrastructure for Distributed Rapid Response to National Emergencies"

($132,371 for one year, No Cost Extension request now pending, PI Neeman, Co-PI Severini).

This grant is funding the development of emergency response capability by turning our big Linux cluster and desktop Condor pool into national emergency computing capacity, capable of switching over in minutes to externally submitted jobs.

Papers from OSCER

- 74 papers enabled by OSCER rounds/help sessions
  - 2006: 30 papers
  - 2005: 16
  - 2004: 12
  - 2003: 5
  - 2002: 8
  - 2001: 3
- 50 papers enabled by OSCER but not by rounds/help sessions
  - 2006: 26 papers
  - 2005: 12
  - 2004: 9
  - 2003: 3

These papers would have been impossible, or much more difficult, or would have taken much longer, without OSCER's direct, hands-on help.

TOTAL: 124 papers, 56 in 2006

http://www.oscer.ou.edu/papers_from_rounds.php

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)

CAPS

- Running daily real time weather forecast suite
- Just got LEAD software up and running, so we are now a LEAD test site
  - LEAD: Linked Environments for Atmospheric Discovery – grid computing for adaptive on-demand forecasting (NSF Information Technology Research)
- Lots and lots of research runs

High Energy Physics

- OU HEP is involved in two worldwide HEP projects: D0 and ATLAS
- D0 status: fully functional on Condor; fully functional on topdawg
- ATLAS status: mostly ready on topdawg, but waiting PanDA's capabilities to utilize external data stager

ACGT

- BLAST: Basic Linear Alignment Search Tool
  - Most popular bioinformatics software
  - Compares strips of genetic data looking for useful patterns
- BLAST status: up and running on topdawg

OSCER Dissemination

it@ou

OU SUPERCOMPUTING CENTER for RESEARCH & EDUCATION
OSCER
UNIVERSITY OF OKLAHOMA

OKLAHOMA
EPSCoR

Our Dissemination Philosophy

SHAMELESS SELF-PROMOTION

Disseminating OSCER

- **NEW!** 1 story in Oklahoman, 2 stories in OU Daily
- **NEW!** Paper just accepted to SIGCSE Bulletin: "Analogies for Teaching Parallel Computing to Inexperienced Programmers" (Neeman, Lee, Mullen, Newman)
- **NEW!** HPCwire.com's "People to Watch 2006"

Disseminating OSCER

- "Oklahoma Innovations" radio show
- Talk: OU Information Technology Symposium 2003, 2004, 2005, **2006**
- Paper, Talk: 3rd LCI International Conference on Linux Clusters, October 2002 ("Supercomputing in Plain English: Teaching High Performance Computing to Inexperienced Programmers")
- Talk: EDUCAUSE Southwest Regional Conf 2003
- Papers (various) acknowledging OSCER

Papers from OSCER

- 74 papers enabled by OSCER rounds/help sessions
  - **2006: 30 papers**
  - 2005: 16
  - 2004: 12
  - 2003: 5
  - 2002: 8
  - 2001: 3
- 50 papers enabled by OSCER but not by rounds/help sessions
  - **2006: 26 papers**
  - 2005: 12
  - 2004: 9
  - 2003: 3

These papers would have been impossible, or much more difficult, or would have taken much longer, without OSCER's direct, hands-on help.

TOTAL: 124 papers, 56 in 2006

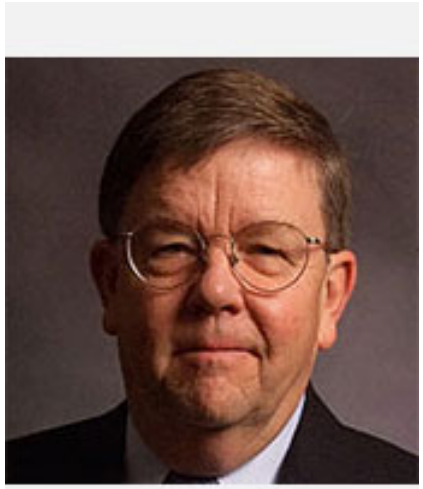
http://www.oscer.ou.edu/papers_from_rounds.php

Okla. Supercomputing Symposium

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

2004 Keynote:
Sang 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/

Supercomputing Symposium 2002

- 5 Participating Universities: OU, Oklahoma State, Cameron, Langston, U Arkansas Little Rock
- 2 Participating companies: Aspen Systems, IBM
- Academic Partners: OK EPSCoR, COEITT
- 69 participants, including 22 students
- Roughly 20 posters
- 9 speakers (6 from OU)
- KEYNOTE: Ron Cooper, Center of Excellence in Information Technology and Telecommunications, Tulsa

Supercomputing Symposium 2003

- Participating Universities: **35 schools** in **13 states & Puerto Rico**
- Participating organizations: NSF, 9 companies, 11 other groups
- Academic Partners: OK EPSCoR, OU VPR, Great Plains Network, OU IT, OSCER
- Industry sponsors (5): Aspen Systems, Atipa Technologies, Dell Computer Corp, Infinicon Systems, Perfect Order
- Approximately 200 participants, including almost 100 students
- Roughly 50 posters, many by students
- 15 speakers (4 from OU)
- KEYNOTE: Peter Freeman, head of NSF CISE

Supercomputing Symposium 2004

- **Over 400 registrations**
- Academic: **37 schools** including **over 150 students** from **13 states** plus **Canada** and **India**
- Government: 16 agencies – 4 federal, 10 state, 2 local
- Industry: **40 companies** – **NEW! Vendor expo**
- Academic Partners: OK EPSCoR, OU VPR, OU IT, OSCER, **NEW! Oklahoma Chamber of Commerce**
- Industry sponsors: 12
  - Platinum: Intel
  - Gold: Perfect Order, Platform Computing, James River Technical, Dell, Oracle
  - Silver: Aspen Systems, Annapolis Micro Devices, Advanced Clustering Technologies
  - Bronze: Internet Security Systems, United Devices, Integrated Technology Solutions
- Roughly 60 posters, many by students
- Keynote: Sangtae Kim, Division Director, NSF Shared Cyberinfrastructure

Supercomputing Symposium 2005

- **390 preregistrations, 285 attendees**
- Academic: **31 schools** from **11 states**
- Government: **16 agencies**: 7 federal, 6 state, 3 local
- Industry: **44 companies**
- Academic Partners: OK EPSCoR, OU VPR, OU IT, OSCER, State Chamber of Commerce
- Industry sponsors: 14
  - Platinum: Intel, Uptime
  - Gold: ADIC, Dell, Foundry Networks, Perfect Order, Precision I/O, Sun
  - Silver: Aspen Systems, Atipa Technologies, CDW-G, Myricom, PathScale
  - Bronze: Advanced Clustering Technologies
- Roughly 40 posters, many by students
- 14 speakers (4 from OU)
- KEYNOTE: Walt Brooks, Director, NASA Advanced Computing Division

Supercomputing Symposium 2006

- **Over 480 preregistrations (NEW RECORD!)**
- Academic: **53 schools (NEW RECORD!)** from **15 states (NEW RECORD!)**
- Government: **27 agencies (NEW RECORD!)**: 12 federal, 11 state, 4 local
- Industry: **60 companies (NEW RECORD!)**
- Academic Partners: Oklahoma EPSCoR, OU IT/OSCER
- Industry sponsors: 15 **(NEW RECORD!)**
  - Platinum: Intel
  - Gold: **Cisco**, Myricom, Versatile
  - Silver: **DataDirect Networks**, **eXludus**, **Spectra Logic**
  - Bronze: Advanced Clustering Technologies, **ClusterFS**, **EverGrid**, **Fabric 7**, **HECMS**, **Microsoft**, **Panasas**
- Roughly 20 posters, many by students
- 26 speakers (9 from OU) **(NEW RECORD!)**
- KEYNOTE: Dan Atkins, head of NSF's Office of Cyberinfrastructure

LCI Conference 2006

OSCER hosted the Linux Clusters Institute conference May 1-4 2006.

This is a more traditional academic conference, with refereed papers and so on.

Conference Chair: Henry Neeman

http://www.linuxclustersinstitute.org/

What Next?

More, MORE, **MORE!**

- More users
- More rounds
- More workshops
- More collaborations (intra- and inter-university; high school; commercial; government; **INTERNATIONAL**)
- **MORE PROPOSALS!**

How Can You Get Involved?

To get involved with OSCER:

- Send e-mail to **hneeman@ou.edu**.
- By OSCER Board policy, to be eligible to use OSCER resources, you must be either:
  - an OU faculty or staff member, or
  - a student working on a research or education project directed/co-directed by an OU faculty or staff member, or
  - a non-OU researcher working on a project that has, as one of its PI/Co-PIs, an OU faculty or staff member.

So talk to us about starting a **collaboration**!

A Bright Future

- OSCER's approach is unique, but it's the right way to go.
- People are taking notice nationally – e.g., you!
- We'd like there to be more and more OSCERs around the country:
  - local centers can react quickly to local needs;
  - inexperienced users need one-on-one interaction to learn how to use supercomputing in their research.

Such a Bargain!

When you hand in a completed EVALUATION FORM, you'll get a beautiful new Oklahoma Supercomputing Symposium 2006 T-SHIRT, **FREE!**

To Learn More About OSCER

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

Thanks for your attention!

Questions?