OSCER: State of the Center

Henry Neeman, OSCER Director

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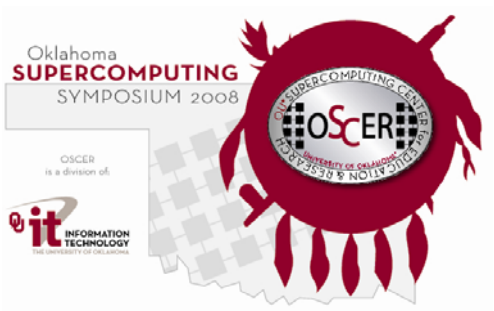
OU Supercomputing Center for Education & Research

A Division of OU Information Technology



ADVANCING RESEARCH CREATING SOLUTIONS

Tuesday October 7 2008

University of Oklahoma

Preregistration Profile

- Organizations
  - **Academic**: registered 62 institutions in 17 states, DC and 1 foreign country (AR, AZ, CO, FL, IA, IL, IN, KS, LA, MO, NC, ND, OK, PA, SD, TN, TX; DC; Costa Rica)
  - **Industry**: registered 29 firms
  - **Government**: registered 13 agencies (federal, state)
  - **Non-governmental**: registered 6 organizations
- Demographics
  - 42% OU, 58% non-OU
  - 84% from EPSCoR states, 16% non-EPSCoR
- Speed
  - 151 registrations in the first 24 hours
  - 202 registrations in the first 7 days

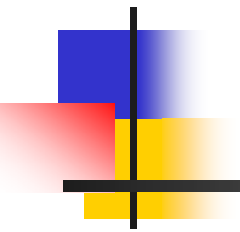
This Year's Big Accomplishments

- Deployed new cluster
- Oklahoma Cyberinfrastructure Initiative

Outline

- Who, What, Where, When, Why, How
- What Does OSCER Do?
  - Resources
  - Education
  - Research
  - Dissemination
- OSCER's Future

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



What is OSCER?

- Division of OU Information Technology
- Multidisciplinary center
- 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
- **NEW! 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
- **NEW! Psychology**
- Radiological Sciences
- Surgery
- Zoology

More than 150 faculty & staff in **26 depts** in Colleges of Arts & Sciences, Atmospheric & Geographic Sciences, Business, Earth & Energy, Engineering, and Medicine – with **more to come**!

Who is OSCER? OU Groups

- 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
- Human Technology Interaction Center
- Institute of Exploration & Development Geosciences
- Instructional Development Program
- Interaction, Discovery, Exploration, Adaptation Laboratory
- Microarray Core Facility
- OU Information Technology
- OU Office of the VP for Research
- Oklahoma Center for High Energy Physics
- Robotics, Evolution, Adaptation, and Learning Laboratory
- Sasaki Applied Meteorology Research Institute
- Symbiotic Computing Laboratory

Who? External Collaborators

1. California State Polytechnic University Pomona (**minority-serving**, **masters**)
2. Colorado State University
3. Contra Costa College (CA, **minority-serving**, **2-year**)
4. Delaware State University (**EPSCoR**, **masters**)
5. Earlham College (IN, **bachelors**)
6. East Central University (OK, **EPSCoR**, **masters**)
7. Emporia State University (KS, **EPSCoR**, **masters**)
8. Great Plains Network
9. Harvard University (MA)
10. Kansas State University (**EPSCoR**)
11. Langston University (OK, **minority-serving**, **EPSCoR**, **masters**)
12. Longwood University (VA, **masters**)
13. Marshall University (WV, **EPSCoR**, **masters**)
14. Navajo Technical College (NM, **tribal**, **EPSCoR**, **2-year**)
15. NOAA National Severe Storms Laboratory (**EPSCoR**)
16. NOAA Storm Prediction Center (**EPSCoR**)
17. Oklahoma Baptist University (**EPSCoR**, **bachelors**)
18. Oklahoma Climatological Survey (**EPSCoR**)
19. Oklahoma Medical Research Foundation (**EPSCoR**)
20. Oklahoma School of Science & Mathematics (EPSCoR, **high school**)
21. Purdue University (IN)
22. Riverside Community College (CA, **2-year**)
23. St. Cloud State University (MN, **masters**)
24. St. Gregory's University (OK, **EPSCoR**, **bachelors**)
25. Southwestern Oklahoma State University (**tribal**, **EPSCoR**, **masters**)
26. Syracuse University (NY)
27. Texas A&M University-Corpus Christi (**masters**)
28. University of Arkansas (**EPSCoR**)
29. University of Arkansas Little Rock (**EPSCoR**)
30. University of Central Oklahoma (**EPSCoR**)
31. University of Illinois at Urbana-Champaign
32. University of Kansas (**EPSCoR**)
33. University of Nebraska-Lincoln (**EPSCoR**)
34. University of North Dakota (**EPSCoR**)
35. University of Northern Iowa (**masters**)

- **YOU COULD BE HERE!**

Who? 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! HPC Application Software Specialist: Josh Alexander (hired July 2008)**
- A little bit of OU IT sysadmin Chris Franklin to run the Condor pool

Who is OSCER? Interns

OSCER has been attracting interns from French universities

- **2008: 2 from Limoges, 3 from Clermont-Ferrand**
- 2007: 3 from Limoges, 3 from Clermont-Ferrand
- 2006: 3 from Limoges, 10 from Clermont-Ferrand
- 2005: 2 from Limoges, 1 from Clermont-Ferrand

Who Are the Users?

Almost 450 users so far, including:

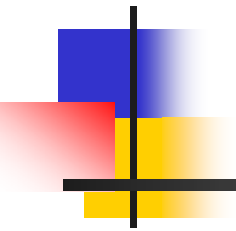
- Roughly equal split between students vs faculty/staff;
- many off campus users;
- … more being added **every month**.

Comparison: The TeraGrid, a national supercomputing metacenter consisting of 11 resource provide sites across the US, has ~4500 unique users.

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

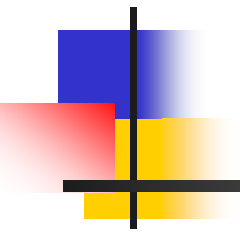
What Does OSCER Do?



What Does OSCER Do?

- Resources
- Teaching
- Research
- Dissemination

OSCER Resources
(and a little history)



2002 OSCER Hardware

- **TOTAL: 1220.8 GFLOPs*, 302 CPU cores, 302 GB RAM**
- Aspen Systems Pentium4 Xeon 32-bit Linux Cluster (Boomer)
  - 270 Pentium4 Xeon CPUs, 270 GB RAM, 1080 GFLOPs
- IBM Regatta p690 Symmetric Multiprocessor (Sooner)
  - 32 POWER4 CPUs, 32 GB RAM, 140.8 GFLOPs
- IBM FAStT500 FiberChannel-1 Disk Server
- Qualstar TLS-412300 Tape Library
- Internet2

* GFLOPs: billions of calculations per second

2005 OSCER Hardware

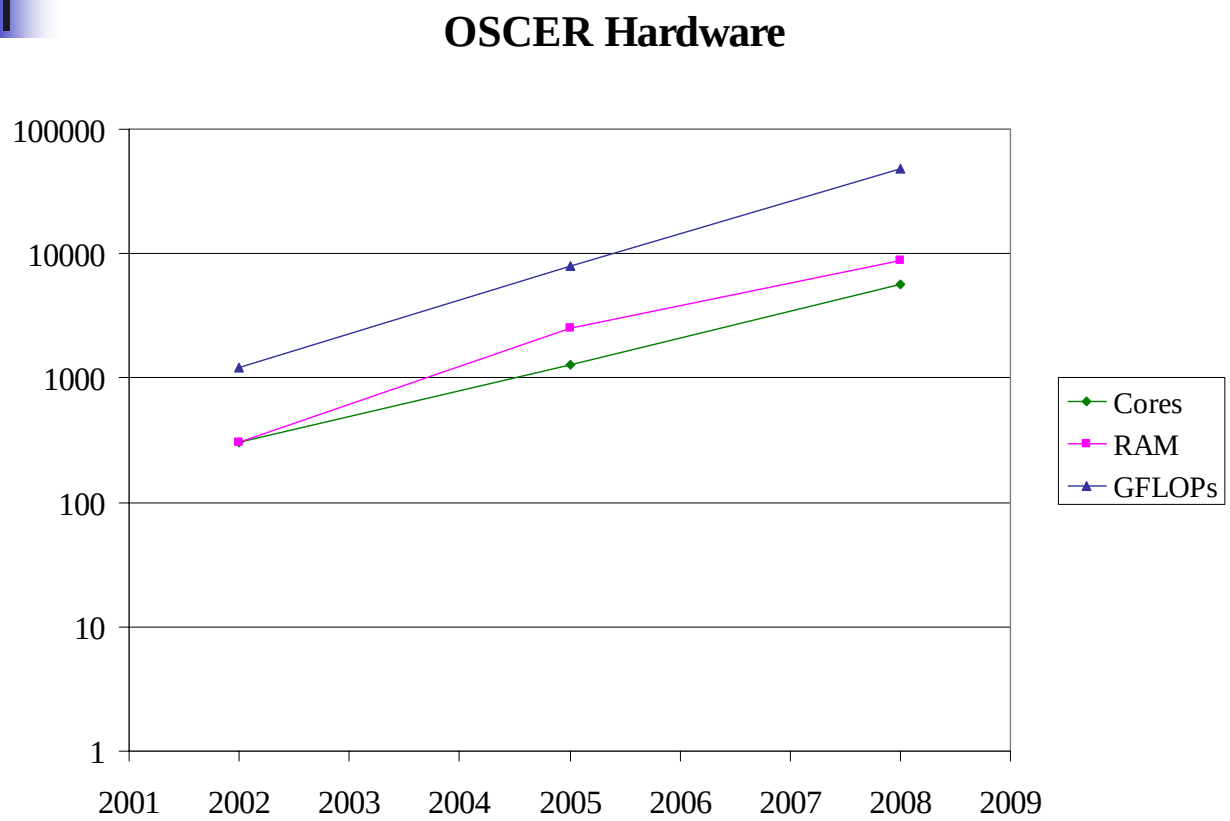
- **TOTAL: 8009 GFLOPs*, 1288 CPU cores, 2504 GB RAM**
- Dell Pentium4 Xeon 64-bit Linux Cluster (Topdawg)
  - 1024 Pentium4 Xeon CPUs, 2176 GB RAM, 6553.6 GFLOPs
- Aspen Systems Itanium2 cluster (Schooner)
  - 64 Itanium2 CPUs, 128 GB RAM, 256 GFLOPs
- Condor Pool: 200 student lab PCs, 1200 GFLOPs
- National Lambda Rail (10 Gbps network), Internet2
- Storage library: Qualstar (10 TB, AIT-3)

* GFLOPs: billions of calculations per second

2008 OSCER Hardware

- **TOTAL: 47,651.68 GFLOPs, 5651 cores, 8768 GB RAM**
- **NEW! Dell Pentium4 Xeon Quad Core Linux Cluster (Sooner)**
  - 529 Xeon 2.0 GHz Harpertown dual socket quad core, 16 GB RAM
  - 3 Xeon 2.33 GHz Clovertown dual socket quad core, 16 GB RAM
  - 2 Xeon 2.4 GHz quad socket quad core nodes, 128 GB RAM each
  - 34,386.88 GFLOPs
  - Coming: ~30 NVIDIA Tesla C1060 cards (933/78 GFLOPs each)
- Condor Pool: 773 lab PCs, 13,264.8 GFLOPs, 2543 GB RAM
  - 183 x Intel Pentium4 32-bit 2.8 GHz with 1 GB RAM each
  - 400 x Intel Core2 Duo 2.4 GHz with 4 GB RAM each
  - **NEW! 190 x Intel Core2 Duo 3.0 GHz with 4 GB RAM each**
- National Lambda Rail, Internet2 (10 Gbps networks)
- Storage library: Overland Storage NEO 8000 (100 TB, LTO)

Improvement in OSCER Hardware



GFLOPs:
2008 = 39 x 2002

RAM:
2008 = 29 x 2002

CPU cores:
2008 = 19 x 2002

Moore's Law:
2008 = 16 x 2002

Intel Xeon Linux Cluster

1,072 Intel Xeon CPU chips/4288 cores:

- 529 x dual socket/quad core Harpertown 2.0 GHz, 16 GB
- 3 x dual socket/quad core Clovertown 2.33 GHz, 16 GB
- 2 x quad socket/quad core, 2.4 GHz, 128 GB each

8,768 GB RAM

~130,000 GB disk

QLogic Infiniband

Force10 Networks Gigabit Ethernet

Platform LSF HPC

Red Hat Enterprise Linux 5

Peak speed: 34,386.88 GFLOPs*

*GFLOPs: billions of calculations per second

sooner.oscer.ou.edu

Intel Xeon Linux Cluster

- First friendly user: Aug 15
- HPL benchmarked Sep 30-Oct 1:
  - 27.11 TFLOPs (78.8% of peak)
  - (hoping for 28 TFLOPs later this week)
- In production: Thu Oct 2
- 80% of cores in use Fri Oct 3

sooner.oscer.ou.edu

Intel Xeon Linux Cluster

Transition: first 6 weeks of usage (porting, tuning, production runs)

- Topdawg
  - 5480 jobs
  - Job failure rate: 55%
- Sooner
  - 48,000+ jobs
  - Job failure rate: 24%

sooner.oscer.ou.edu

Intel Xeon Linux Cluster

Deployment

- OSCER operations staff worked ridiculously long hours nonstop for three months.
- They all went above and beyond, under extremely difficult circumstances.
- We're extraordinarily fortunate to have such an amazing crew.
- Thank them every chance you get!

sooner.oscer.ou.edu

Decommissioned

1,024 Pentium4 Xeon CPUs
2,176 GB RAM
23,000 GB disk
Infiniband & Gigabit Ethernet
OS: Red Hat Linux Enterp 4
Peak speed: 6,553 GFLOPs*
*GFLOPs: billions of calculations per second

topdawg.oscer.ou.edu

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topdawg.oscer.ou.edu

About to be Decommissioned

- 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

About to be Decommissioned

64 Itanium2 1.0 GHz CPUs
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Aspen Systems Inc.

schooner.oscer.ou.edu

Condor Pool

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

OU IT has deployed a large Condor pool (773 desktop PCs in IT student labs all over campus).

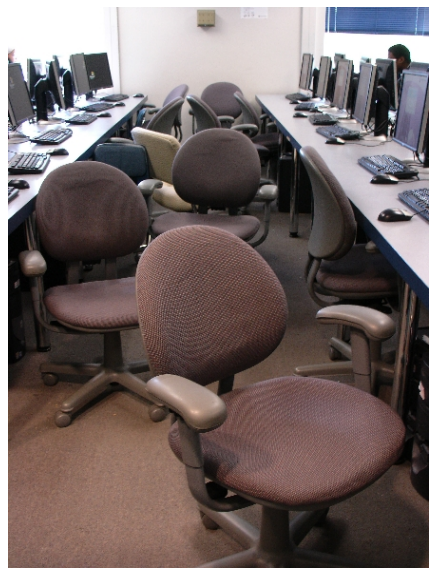
It provides a huge amount of additional computing power – more than was available in all of OSCER in 2005.

And, the cost is very very low – almost literally free.

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

Current Status at OU

- Deployed to 773 machines in OU IT PC labs
- Submit/management from old 32-bit Xeon nodes
- Fully utilized
- Some machines are burping, but will be fixed shortly
- **COMING:** 2 submit/management nodes, 2.5 TB RAID



Tape Library

Overland Storage NEO 8000

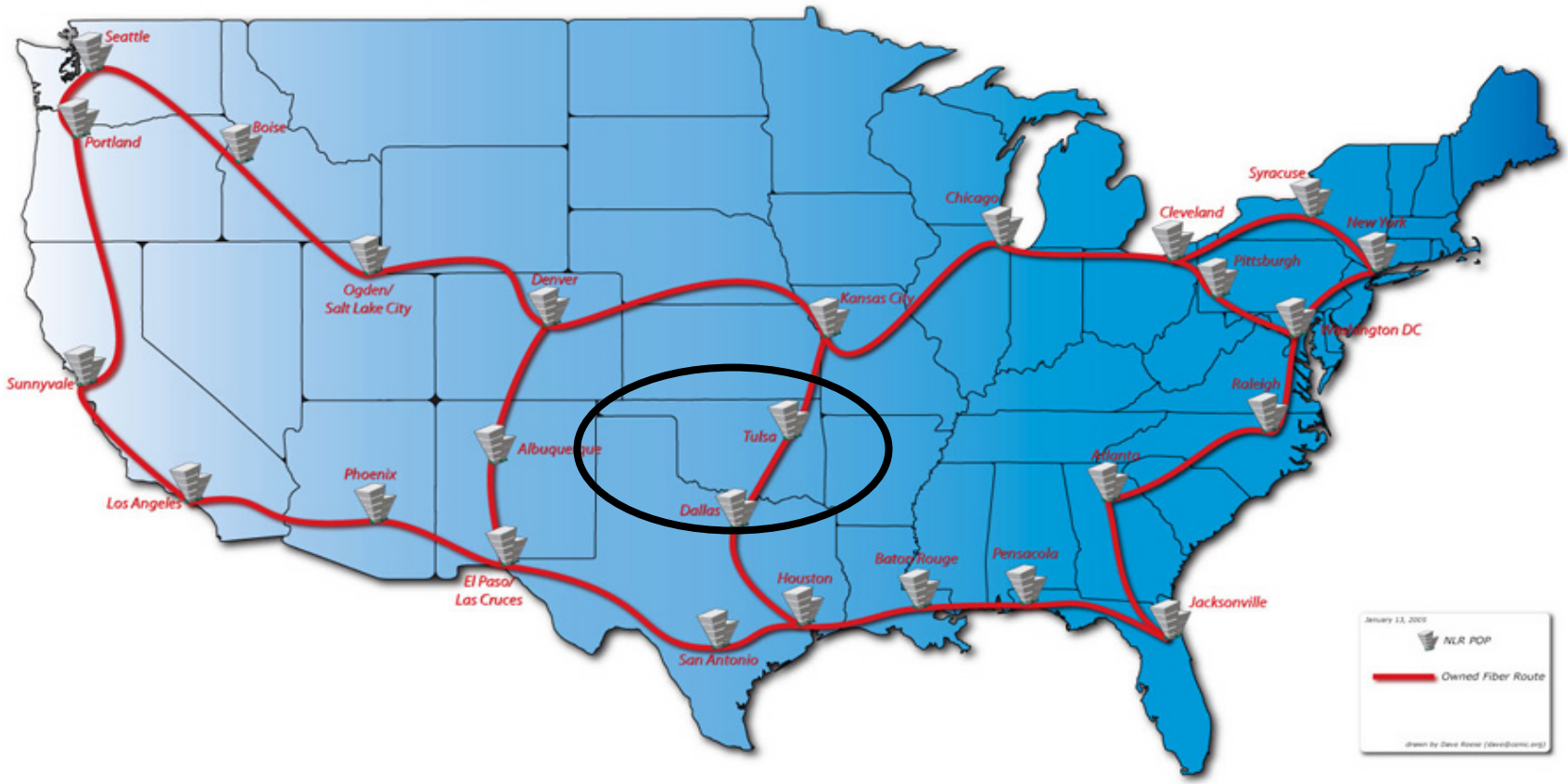
LTO-3/LTO-4

Current capacity 100 TB raw

Expandable to 400 TB raw

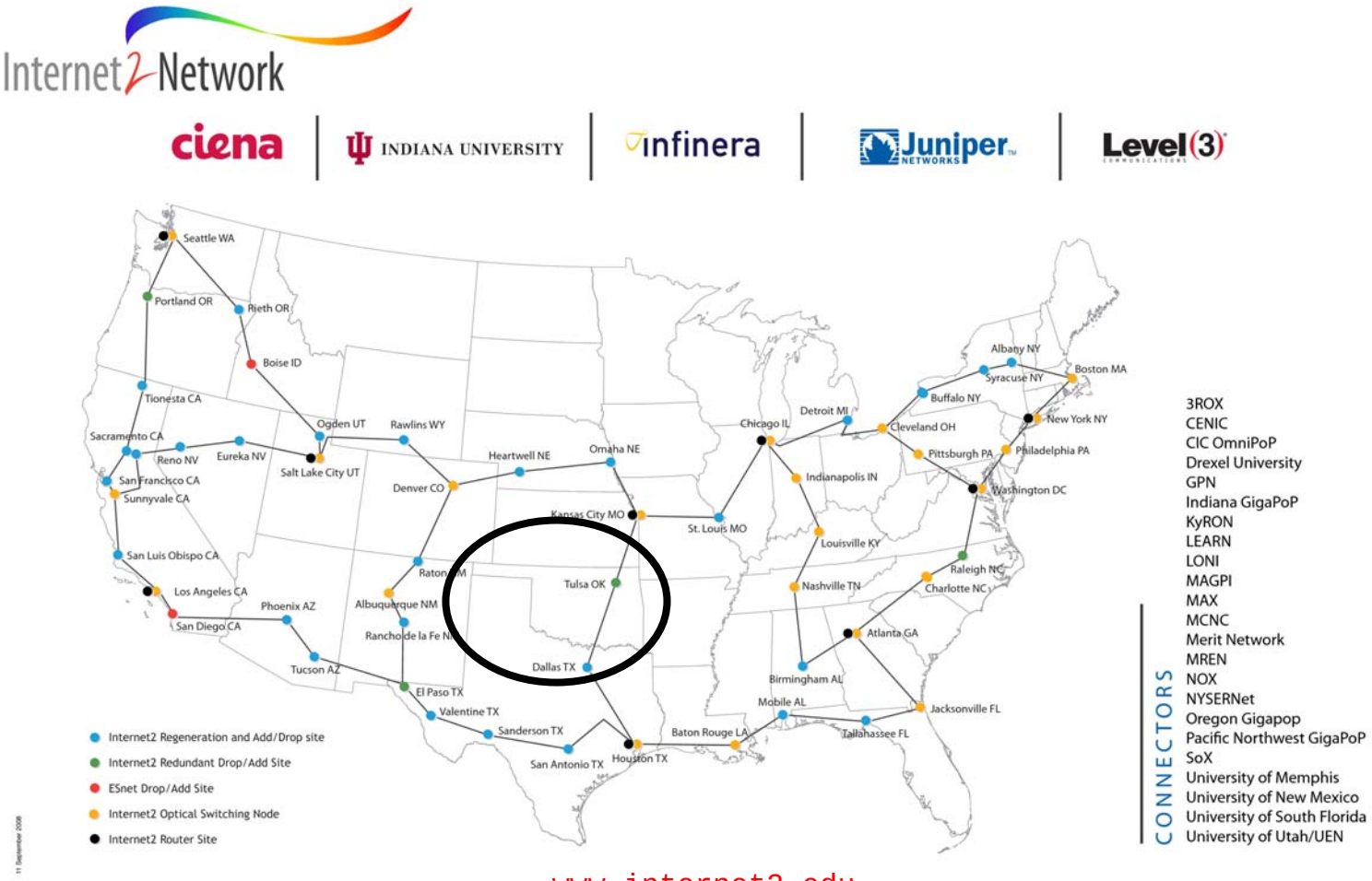
EMC DiskXtender

National Lambda Rail



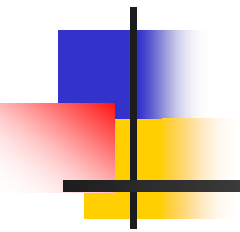
For more net

Internet2



www.internet2.edu

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 400 from 2001 to 2007

Workshop Topics

- Overview
- The Storage Hierarchy
- Instruction Level Parallelism
- High Performance Compilers
- Shared Memory Parallelism
- Distributed Parallelism
- Multicore
- High Throughput Computing
- 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
  - **Fall 2007: 41 @ OU, 80 at 28 other institutions**
- NCSI Parallel & Cluster Computing workshop (summer 2004, summer 2005)
- Linux Clusters Institute workshop (June 2005, Feb 2007)
- Co-taught at NCSI Parallel & Cluster Computing workshop at Houston Community College (May 2006)
- **NEW! SC07 Education Committee Parallel Programming & Cluster Computing workshop Tue Oct 2 (the day before the 2007 Symposium)**
- **NEW! SC08 Education Committee Parallel Programming & Cluster Computing workshop Aug 10-16**
- **NEW! SC08 Education Committee Parallel Programming & Cluster Computing workshop Mon Oct 6**

… and more to come.

OU is the only institution in the world to host and co-instruct multiple workshops sponsored by each of NCSI, LCI and the SC education program.

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)

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
  - National Educational Computing Conference 2006 (virtual tour via videoconference)
  - Norman (OK) Lions Club
  - **NEW! Society for Information Technology & Teacher Education conference 2008**
  - **NEW! Acxiom Conference on Applied Research in Information Technology 2008**
  - **NEW! Shawnee (OK) Lions Club**

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- Other Universities
  1. SUNY Binghamton (NY)
  2. Bradley University (IL)
  3. **REPEAT! Cameron University (OK)**
  4. **NEW! DeVry University (OK)**
  5. **NEW! East Central University (OK)**
  6. El Bosque University (Colombia)
  7. Southwestern University (TX)
  8. Louisiana State University
  9. Midwestern State University (TX)
  10. Northwestern Oklahoma State University
  11. Oklahoma Baptist University
  12. Oklahoma City University
  13. Oklahoma State University – OKC
  14. Oral Roberts University (OK)
  15. St. Gregory's University (OK)
  16. Southeastern Oklahoma State University (TORUS)
  17. Southwestern Oklahoma State University
  18. Texas A&M-Commerce
  19. University of Arkansas Fayetteville
  20. University of Arkansas at Little Rock
  21. 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
  - 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

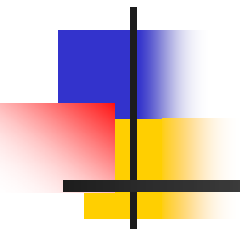
OU undergrads, grad students, staff and faculty learn how to use supercomputing in their specific research.

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.



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

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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.

Spring Storm Experiment 2008

OSCER played a major role in the Spring Storm Experiment, which involved the Center for Analysis & Prediction of Storms, the NOAA Storm Prediction Center, the Pittsburgh Supercomputing Center, and others.

We were the primary HPC provider for the part of the project run by the Center for Collaborative Adaptive Sensing of the Atmosphere (CASA).

This project consumed about 1/3 of topdawg for 2 1/2 months.

OU and D0

12/26/06 - 12/26/07	Events	Data
#1 Michigan State U	33,677,505	2.81 TB
#2 U Oklahoma	**16,516,500**	**1.32 TB**
#3 U Florida	13,002,028	1.07 TB
#4 UC San Diego	10,270,250	0.81 TB
#5 U Nebraska	8,956,899	0.71 TB
#6 Indiana U	4,111,740	0.35 TB
#7 U Wisconsin	3,796,497	0.30 TB
#8 Louisiana Tech U	3,224,405	0.25 TB
#9 Langston U (OK)	1,574,062	0.11 TB

OU D0 Breakdown

- OSCER's big cluster (topdawg)
  8,020,250 events (6th in the US), 0.66 TB
- OSCER Condor pool
  6,024,000 events (6th in the US), 0.49 TB
- Dedicated OU HEP Tier3 cluster
  2,472,250 events (9th in the US), 0.16 TB

Notes:

- Without OSCER's Condor pool, OU would be #4.
- Without OSCER's cluster, OU would be #6.
- Without OU HEP's dedicated Tier3 cluster, OU would still be #2.

OU and ATLAS

4/4/2007 – 4/27/2008	Wallclock Hours
#1 Boston U	325,700
#2 U Chicago	297,600
#3 Indiana U	235,400
#4 Michigan State U	170,000
#5 UT Arlington	160,300
#6 U Oklahoma	145,700

http://gratia-osg.fnal.gov:8880/gratia-reporting/

Note: A buggy version of gratia ran on OU's resources until 4/3/2008.

OU: First in the World

OU was the first institution in the world to simultaneously run ATLAS and D0 grid production jobs on a general-purpose, multi-user cluster.

Most grid production jobs run on dedicated clusters that are reserved for one or the other of these projects, or on Condor pools.

External Research Grants

- S. Schroeder, "Discovering Satellite Tobacco Mosaic Virus Structure," OCAST, $85K
- S. Schroeder, "Computational Advacnes Toward Predicting Encapsidated Viral RNA Structure," Pharmaceutical Research and Manufactuerer's Association of America, $60K
- R. Kolar, "Outer Boundary Forcing for Texas Coastal Models," Texas Water Development Board, $20K
- Y. Kogan, "Midlatitude Aerosol-Cloud-Radiation Feedbacks in Marine Boundary Layer Clouds", ONR, $638K
- A. McGovern, "Developing Spatiotemporal Relational Models to Anticipate Tornado Formation," NSF, $500K
- K. Milton, "Collaborative Research: Quantum Vacuum Energy", NSF, $250K
- J. Straka, K. Kanak, Davies-Jones, "Challenges in understanding tornadogenesis and associated phenomena," NSF, $854K (total), $584K (OU)
- Y. Hong, "Improvement of the NASA Global Hazard System and Implement Server-Africa," NASA, $272K
- J. Antonio, S. Lakshmivarahan, H. Neeman, "Predictions of Atmospheric Dispersion of Chemical and Biological Contaminants in the Urban Canopy." Subcontract No. 1334/0974-01, Prime Agency DOD-ARO, Subcontract through Texas Tech University, Lubbock, TX, Sep. 29, 2000 to Nov. 3, 2001, $75K
- A. Striolo, "Electrolytes at Solid-Water Interfaces: Theoretical Studies for Practical Applications," OSRHE Nanotechnology, $15K
- M. Xue, J. Gao, "An Investigation on the Importance of Environmental Variability to Storm-scale Radar Data Assimilation," NSSL, $72K
- J. Gao, K. Brewster, M. Xue, K. Droegemeier, "Assimilating Doppler Radar Data for Storm-Scale Numerical Prediction Using an Ensemble-based Variational Method," NSF, $200K
- M. Xue, K. Brewster, J. Gao, "Study of Tornado and Tornadic Thunderstorm Dynamics and Predictability through High-Resolution Simulation, Prediction and Advanced Data Assimilation," NSF, $780K

OSCER-RELATED FUNDING TO DATE:
$62.6M total, $36.5M to OU

External Research Grants (cont'd)

- 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

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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 (cont'd)

- 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

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External Research Grants (cont'd)

- 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
- A. Striolo, "Heat Transfer in Graphene-Oil Nanocomposites: A Molecular Understanding to Overcome Practical Barriers." ACS Petroleum Research Fund, $40K
- D.V. Papavassiliou, "Turbulent Transport in Anisotropic Velocity Fields," NSF, $292.5K
- V. Sikavistsas and D.V. Papavassiliou , "Flow Effects on Porous Scaffolds for Tissue Regeneration," NSF, $400K
- D. Oliver, software license grant, $1.5M
- R. Broughton et al, "Assembling the Eutelost Tree of Life – Addressing the Major Unresolved Problem in Vertebrate Phylogeny," NSF, $3M ($654K to OU)

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Papers from OSCER

- **103** publications enabled by OSCER rounds/help sessions
  - 2008: 16 papers
  - 2007: 11
  - 2006: 31
  - 2005: 17
  - 2004: 12
  - 2003: 5
  - 2002: 8
  - 2001: 3

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

- **185** publications enabled by OSCER resources only
  - 2008: 81 papers
  - 2007: 53
  - 2006: 26
  - 2005: 13
  - 2004: 9
  - 2003: 3

Includes:

- 14 MS theses
- 8 PhD dissertations

TOTAL: 288 publications, 97 in 2008

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

OK Cyberinfrastructure Initiative

- Oklahoma is an EPSCoR state.
- Oklahoma submitted an NSF EPSCoR Research Infrastructure Proposal in Jan 2008 (up to $15M).
- This year, for the first time, all NSF EPSCoR RII proposals MUST include a statewide Cyberinfrastructure plan.
- Oklahoma's plan – the Oklahoma Cyberinfrastructure Initiative (OCII) – involves:
  - all academic institutions in the state are eligible to sign up for free use of OU's and OSU's centrally-owned CI resources;
  - other kinds of institutions (government, NGO, commercial) are eligible to use, though not necessarily for free.
- To join: See Henry after this talk.

NSF CI-TEAM Grant

"Cyberinfrastructure Education for Bioinformatics and Beyond" ($250,000, 12/01/2006 – 11/30/2008)

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

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

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
(28 institutions in 15 states)

1. California State U Pomona (masters-granting, minority serving): Lee
2. Colorado State U: Kalkhan
3. Contra Costa College (CA, 2-year, minority serving): Murphy
4. Delaware State U (masters, EPSCoR): Lin, Mulik, Multnovic, Pokrajac, Rasamny
5. Earlham College (IN, bachelors): Peck
6. East Central U (OK, masters, EPSCoR): Crittell,Ferdinand, Myers, Walker, Weirick, Williams
7. Emporia State U (KS, masters-granting, EPSCoR): Ballester, Pheatt
8. Harvard U (MA): King
9. Kansas State U (EPSCoR): Andresen, Monaco
10. Langston U (OK, masters, minority serving, EPSCoR): Snow, Tadesse
11. Longwood U (VA, masters): Talaiver
12. Marshall U (WV, masters, EPSCoR): Richards
13. Navajo Technical College (NM, 2-year, tribal, EPSCoR): Ribble
14. Oklahoma Baptist U (bachelors, EPSCoR): Chen, Jett, Jordan
15. Oklahoma Medical Research Foundation (EPSCoR): Wren
16. Oklahoma School of Science & Mathematics (high school, EPSCoR): Samadzadeh
17. Purdue U (IN): Chaubey
18. Riverside Community College (CA, 2-year): Smith
19. St. Cloud State University (MN, masters): J. Herath, S. Herath, Guster
20. St. Gregory's U (OK, 4-year, EPSCoR): Meyer
21. Southwestern Oklahoma State U (masters, EPSCoR, tribal): Linder, Moseley, Pereira
22. Syracuse U (NY): Stanton
23. Texas A&M U-Corpus Christi (masters): Scherger
24. U Arkansas Fayetteville (EPSCoR): Apon
25. U Arkansas Little Rock (masters, EPSCoR): Hall, Jennings, Ramaswamy
26. U Central Oklahoma (masters-granting, EPSCoR): Lemley, Wilson
27. U Illinois Urbana-Champaign: Wang
28. U Kansas (EPSCoR): Bishop, Cheung, Harris, Ryan
29. U Nebraska-Lincoln (EPSCoR): Swanson
30. U North Dakota (EPSCoR): Bergstrom, Hoffman, Majidi, Moreno, Peterson, Simmons, Wiggen, Zhou
31. U Northern Iowa (masters-granting): Gray

NSF CI-TEAM Grant

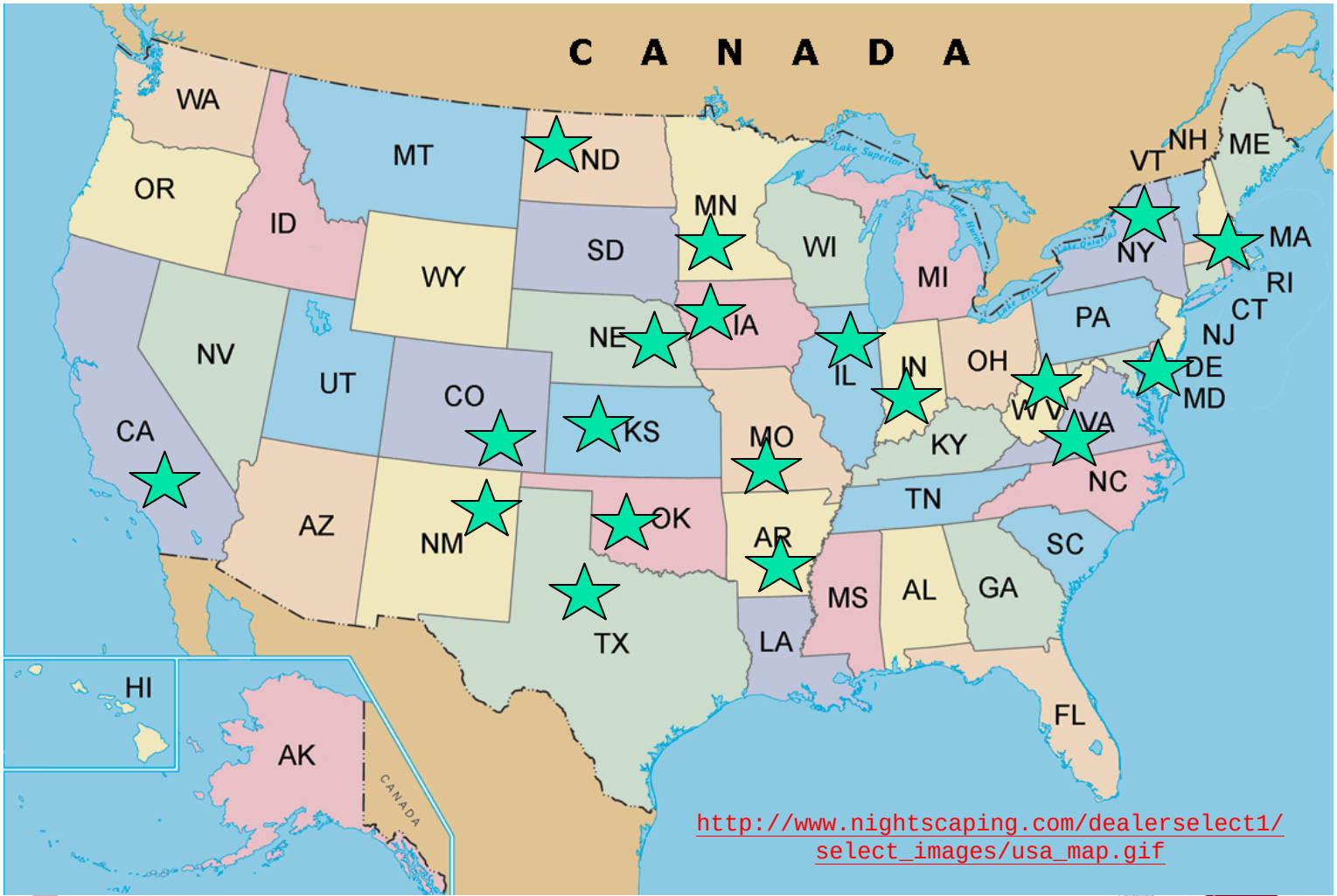
"Cyberinfrastructure Education for Bioinformatics and Beyond" ($250,000)

OSCER provided "Supercomputing in Plain English" workshops via videoconferencing starting in Fall 2007.

Roughly 180 people at 29 institutions nationwide, via:

- Access Grid
- VRVS
- iLinc
- QuickTime
- Phone bridge (land line)

NSF CI-TEAM Participants



NSF CI-TEAM Grant

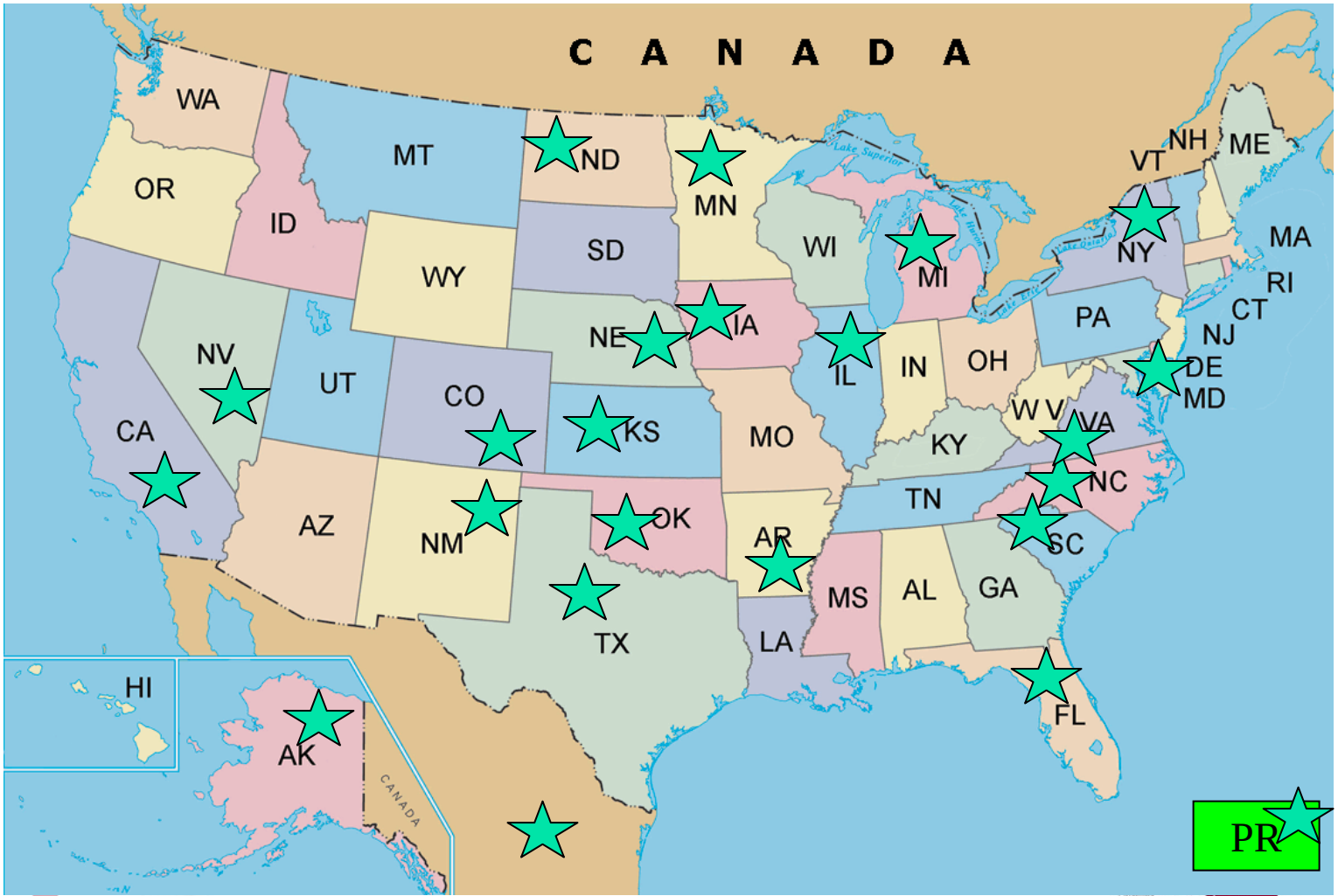
"Cyberinfrastructure Education for Bioinformatics and Beyond" ($250,000)

OSCER is providing "Supercomputing in Plain English" workshops via videoconferencing starting in Fall 2007.

~180 people at 29 institutions across the US and Mexico, via:

- Access Grid
- VRVS
- iLinc
- QuickTime
- Phone bridge (land line)

SiPE Workshop Participants 2007



NSF CI-TEAM Grant

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

OSCER has produced software for installing Linux-enabled Condor inside a Windows PC.

INTERESTED? Contact Henry (hneeman@ou.edu)

NSF CI-TEAM Grant

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

OSCER is 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)

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're seeing 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.
  - Coalition for Academic Scientific Computing (CASC): 57 academic and government supercomputing centers

What a Bargain!

When you hand in a completed **EVALUATION FORM**, you'll get a beautiful new Oklahoma Supercomputing Symposium 2008 T-SHIRT, **FREE!**

And don't forget your FREE mug, your FREE post-it pad, your FREE pen and your FREE goodie bag!

Thanks!

- Academic sponsors: Oklahoma EPSCoR, Great Plains Network
- Industry sponsors
  - Platinum: Intel
  - Gold: Platform Computing, Sun Microsystems
  - Silver: BlueArc, Ciena, Ethernet Alliance, Panasas, Qualstar, Silicon Mechanics
  - Bronze: Ace, Advanced Clustering Technologies, Dell, Librato, Server Technology

Thanks!

- OU IT
  - OU CIO/VPIT Dennis Aebersold
  - Associate VPIT Loretta Early
  - Symposium coordinator Michelle Wiginton
  - Assistant to the CIO Pam Ketner
  - All of the OU IT folks who helped put this together
- CCE Forum
  - Deb Corley
  - The whole Forum crew who helped put this together

Thanks!

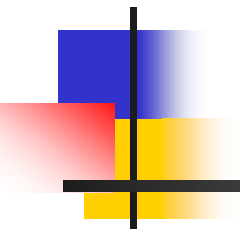
- Keynote speaker: José Muñoz
- Plenary Speakers: Michael Mascagni, Stephen Wheat
- Breakout speakers
  - Joshua Alexander, University of Oklahoma
  - John Antonio, University of Oklahoma
  - Keith Brewster, University of Oklahoma
  - Dana Brunson, Oklahoma State University
  - Karen Camarda, Washburn University
  - Wesley Emeneker, University of Arkansas
  - Jeni Fan, University of Oklahoma
  - Robert Ferdinand, East Central University
  - Larry Fisher, Creative Consultants
  - Dan Fraser, University of Chicago
  - Roger Goff, Sun Microsystems
  - Paul Gray, University of Northern Iowa
- Breakout speakers (continued)
  - Tim Handy, University of Central Oklahoma
  - Takumi Hawa, University of Oklahoma
  - Scott Lathrop, TeraGrid
  - Evan Lemley, University of Central Oklahoma
  - William Lu, Platform Computing
  - Kyran (Kim) Mish, University of Oklahoma
  - Greg Monaco, Great Plains Network
  - Jeff Pummill, University of Arkansas
  - Jeff Rufinus, Widener University
  - Susan J. Schroeder, University of Oklahoma
  - Horst Severini, University of Oklahoma
  - Dan Stanzione, Arizona State University
  - Bradley C. Wallet, University of Oklahoma
  - Dan Weber, Tinker Air Force Base
  - Kenji Yoshigoe, University of Arkansas at Little Rock

Thanks!

- To all of your for participating, and to those many of you who've shown us so much loyalty over the past 7 years.

To Learn More About OSCER

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



Thanks for your attention!

Questions?