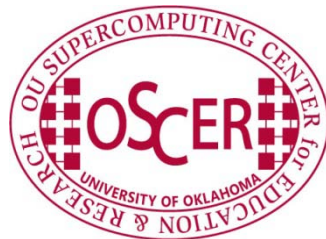


OSCER: State of the Center

Henry Neeman, OSCER Director

hneeman@ou.edu

**OU Supercomputing Center for Education & Research
A Division of OU Information Technology**



Wednesday October 6 2010
University of Oklahoma

Preregistration Profile

- Organizations
 - **Academic**: preregistered 32 institutions in 7 states (AR,IL,IN,KS,LA,OK,TX)
 - Includes 25 institutions in 4 EPSCoR states (AR,KS,LA,OK)
 - **Industry**: preregistered 21 firms
 - **Government**: preregistered 11 agencies (federal, state, local)
 - **Non-governmental**: preregistered 6 organizations
- Demographics (preregistrations)
 - 46% OU, 54% non-OU
 - 77% Oklahoma, 23% non-Oklahoma
 - 85% from EPSCoR states, 15% non-EPSCoR
 - 81% academic, 19% non-academic



OSCER State of the Center Address
Wednesday October 6 2010



Some Accomplishments

- NSF EPSCoR C2, MRI grants
- Over 4 million batch jobs run already on Sooner, the cluster that we deployed a year ago – over 3 times all of the jobs on the previous cluster, Topdawg, over its entire lifetime!
- In Oklahoma, we've now given the “Supercomputing in Plain English” overview talk to 11 of 13 public universities, 7 private universities, 1 tribal college and 1 high school.
- Outside Oklahoma, we've given that talk to 9 universities in other states and one in another country.
- MATLAB on our cluster is now available to non-OU users.



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Outline

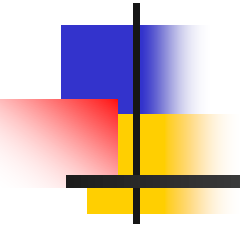
- Who, What, Where, When, Why, How
- What Does OSCER Do?
 - Resources
 - Education
 - Research
 - Dissemination
- OSCER's Future



OSCER State of the Center Address
Wednesday October 6 2010



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)



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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
- 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!



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Who is OSCER? OU Groups

1. Advanced Center for Genome Technology
2. Center for Analysis & Prediction of Storms
3. Center for Aircraft & Systems/Support Infrastructure
4. Cooperative Institute for Mesoscale Meteorological Studies
5. Center for Engineering Optimization
6. Fears Structural Engineering Laboratory
7. Human Technology Interaction Center
8. Institute of Exploration & Development Geosciences
9. Instructional Development Program
10. Interaction, Discovery, Exploration, Adaptation Laboratory
11. Microarray Core Facility
12. OU Information Technology
13. OU Office of the VP for Research
14. Oklahoma Center for High Energy Physics
15. Robotics, Evolution, Adaptation, and Learning Laboratory
16. Sasaki Applied Meteorology Research Institute
17. Symbiotic Computing Laboratory

E M E W



OSCER State of the Center Address
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Oklahoma Collaborators

1. Cameron U (**masters**)
 2. East Central U (**masters**)
 3. Langston U (**minority-serving, masters**)
 4. NOAA National Severe Storms Laboratory
 5. NOAA Storm Prediction Center
 6. Northeastern State U (**masters**)
 7. Oklahoma Baptist U (**bachelors**)
 8. Oklahoma City U (**masters**)
 9. Oklahoma Climatological Survey
 10. Oklahoma Medical Research Foundation
 11. **NEW! Oklahoma Panhandle State U**
 12. Oklahoma School of Science & Mathematics (**high school**)
 13. Oklahoma State U (Stillwater)
 14. Rogers State U (**masters**)
 15. St. Gregory's U (**bachelors**)
 16. Samuel Roberts Noble Foundation
 17. Southeastern Oklahoma State U (**masters**)
 18. **NEW! Southern Nazarene U** (**masters**)
 19. Southwestern Oklahoma State U (**masters**)
 20. U Central Oklahoma (**masters**)
 21. U Tulsa
- **YOU COULD BE HERE!**



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National Collaborators (22 states)

1. California State Polytechnic U Pomona (**minority-serving, masters**)
 2. Colorado State U
 3. Contra Costa College (CA, **minority-serving, 2-year**)
 4. Delaware State U (**EPSCoR, masters**)
 5. Earlham College (IN, **bachelors**)
 6. Emporia State U (KS, **EPSCoR, masters**)
 7. Florida State U E ∩ ∃ ⊥
 8. Georgia Institute of Technology
 9. Great Plains Network
 10. Harvard U (MA)
 11. Indiana U
 12. Kansas State U (**EPSCoR**)
 13. Kean U (NJ)
 14. Longwood U (VA, **masters**)
 15. Marshall U (WV, **EPSCoR, masters**)
 16. Navajo Technical College (NM, **tribal, EPSCoR, 2-year**)
 17. Purdue U (IN)
 18. Riverside Community College (CA, **2-year**)
 19. St. Cloud State U (MN, **masters**)
 20. Syracuse U (NY)
 21. Texas A&M U
 22. Texas A&M U-Corpus Christi (**masters**)
 23. U Arkansas (**EPSCoR**)
 24. U Arkansas Little Rock (**EPSCoR**)
 25. U California Santa Barbara
 26. U Illinois at Urbana-Champaign
 27. U Kansas (**EPSCoR**)
 28. U Nebraska-Lincoln (**EPSCoR**)
 29. U North Dakota (**EPSCoR**)
 30. U Northern Iowa (**masters**)
 31. U Utah (**EPSCoR**)
 32. Widener U (**masters**)
 33. Worcester Polytechnic Institute (MA)
- **YOU COULD BE HERE!**



OSCER State of the Center Address
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Who Are the Users?

Over 700 users so far, including:

- Roughly equal split between students vs faculty/staff (students are the bulk of the active users);
- many off campus users (roughly 20%);
- ... more being added every month.

Comparison: TeraGrid, consisting of 11 resource provide sites across the US, has ~5000 unique users.

Fun Fact: Oklahoma's HPC user density per 100,000 population is roughly 9 times as high as TeraGrid's.

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
- **Chemical Engineering:** lots and lots of molecular dynamics



OSCER State of the Center Address
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Who? OSCER Personnel

- Director: Henry Neeman
- Associate Director for Remote & Heterogeneous Computing: Horst Severini
- Manager of Operations: Brandon George
- System Administrator: David Akin
- System Administrator: Brett Zimmerman
- HPC Application Software Specialist: Josh Alexander
- A little bit of OU IT sysadmin Chris Franklin to run the Condor pool.



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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 CSE is seen as needing too much computing background, and as needing 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!**



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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? Teaching



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



OSCER State of the Center Address
Wednesday October 6 2010



What Does OSCER Do? Rounds



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



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ADVANCING RESEARCH • CREATING SOLUTIONS

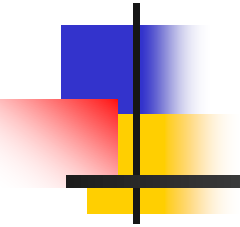


OSCER State of the Center Address
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OSCEP Resources

(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



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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



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Current OSCER Hardware

- **TOTAL: 54,626.88 GFLOPs; 6304 cores; 12,390 GB RAM**
- Dell Xeon Quad Core Linux Cluster (Sooner)
 - 531 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
 - 34,514.88 GFLOPs
 - 24 NVIDIA Tesla C1060 cards (933/78 GFLOPs each)
- Condor Pool: 795 lab PCs, 20,112 GFLOPs, 3590 GB RAM
 - 205 x Intel Core i7 quad 2.4 GHz with 6 GB RAM each
 - 400 x Intel Core2 Duo 2.4 GHz with 4 GB RAM each
 - 190 x Intel Core2 Duo 3.0 GHz with 4 GB RAM each
- National Lambda Rail, Internet2 (10 Gbps networks)

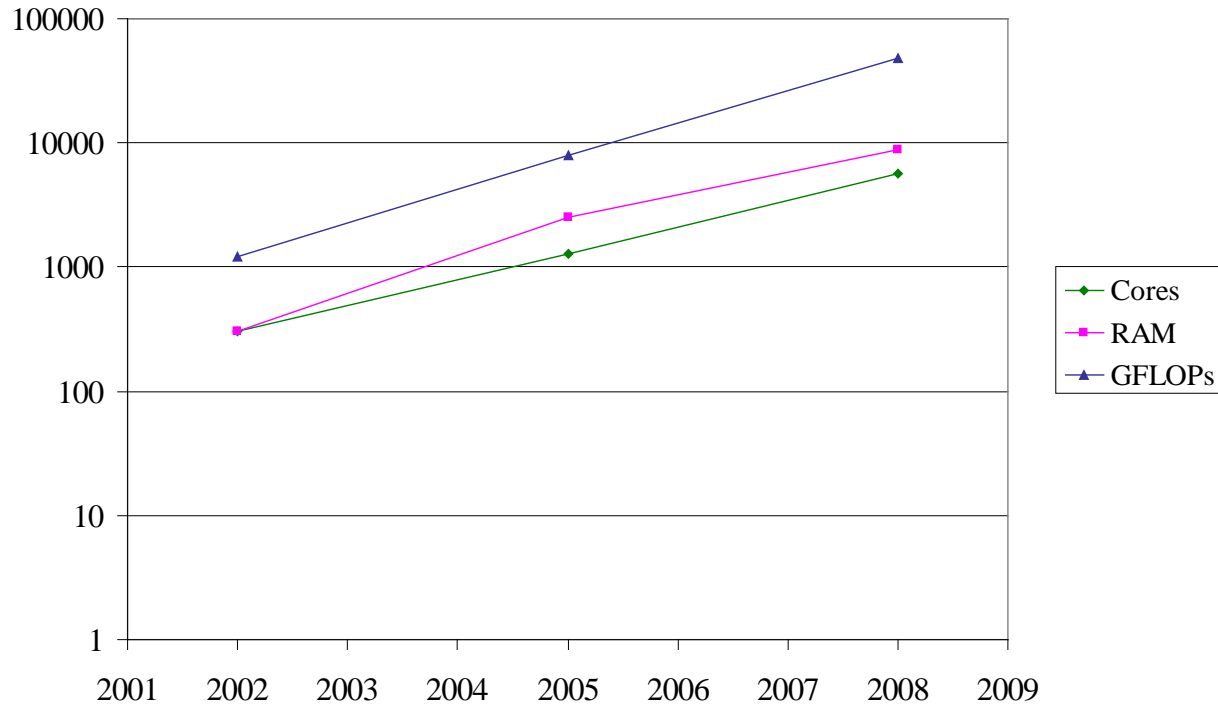


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Improvement in OSCER Hardware

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

OK Cyberinfrastructure Initiative

- All academic institutions in Oklahoma 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.
- Everyone can participate in our CI education initiative.
- The Oklahoma Supercomputing Symposium, our annual conference, continues to be offered to all.



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Dell Intel Xeon Linux Cluster

1,076 Intel Xeon CPU chips/4288 cores

- 528 dual socket/quad core Harpertown 2.0 GHz, 16 GB each
- 3 dual socket/quad core Harpertown 2.66 GHz, 16 GB each
- 3 dual socket/quad core Clovertown 2.33 GHz, 16 GB each
- 2 x quad socket/quad core Tigerton, 2.4 GHz, 128 GB each

8,800 GB RAM

~130 TB globally accessible disk

QLogic Infiniband

Force10 Networks Gigabit Ethernet

Red Hat Enterprise Linux 5

Peak speed: 34.5 TFLOPs*

*TFLOPs: trillion calculations per second



sooner.oscer.ou.edu



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Dell Intel Xeon Linux Cluster

DEBUTED NOVEMBER 2008 AT:

- #90 worldwide
- #47 in the US
- #14 among US academic
- #10 among US academic excluding TeraGrid
- #2 in the Big 12
- #1 in the Big 12 excluding TeraGrid



`sooner.oscer.ou.edu`



OSCAR State of the Center Address
Wednesday October 6 2010



Dell Intel Xeon Linux Cluster

Purchased mid-July 2008

First friendly user Aug 15 2008

Full production Oct 3 2008

**Christmas Day 2008: >~75% of
nodes and ~66% of cores were in
use.**



`sooner.oscer.ou.edu`



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Condor Pool

Condor is a software technology that allows idle desktop PCs to be used for number crunching.

OU IT has deployed a large Condor pool (795 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.

20+ TFLOPs peak compute speed.

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.



National Lambda Rail



Internet2

Internet2 Network

ciena

Ψ INDIANA UNIVERSITY

infinera

Juniper NETWORKS

Level(3) COMMUNICATIONS



- CONNECTORS**
- 3ROX
 - CENIC
 - CIC OmniPoP
 - Drexel University
 - GPN
 - Indiana GigaPoP
 - KyRON
 - LEARN
 - LONI
 - MAGPI
 - MAX
 - MCNC
 - Merit Network
 - MREN
 - NOX
 - NYSERNet
 - Oregon Gigapop
 - Pacific Northwest GigaPoP
 - SoX
 - University of Memphis
 - University of New Mexico
 - University of South Florida
 - University of Utah/UEN

11 September 2008

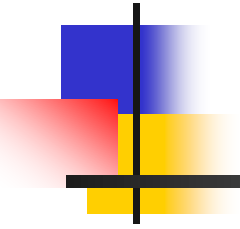
www.internet2.edu



OSCER State of the Center Address
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What Does OSCER Do?





What Does OSCER Do?

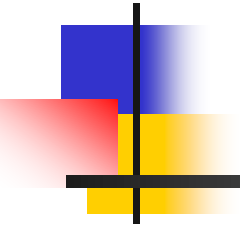
- Resources
- Teaching
- Research
- Dissemination
- Oklahoma Cyberinfrastructure Initiative



OSCER State of the Center Address
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OSCER Teaching



What Does OSCER Do? Teaching



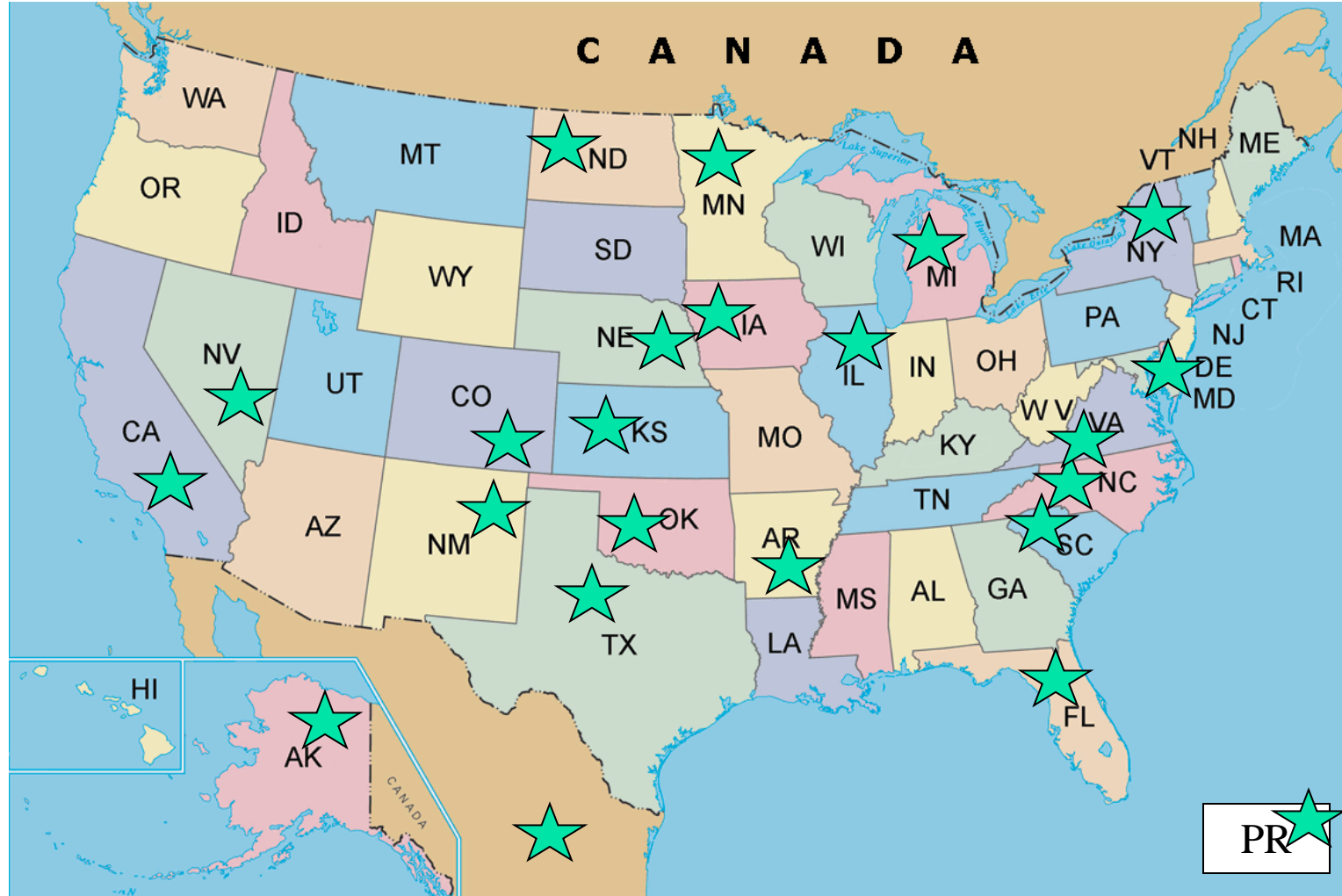
Science and engineering faculty from all over America learn supercomputing at OU by playing with a jigsaw puzzle (NCSI @ OU 2004).



OSCER State of the Center Address
Wednesday October 6 2010



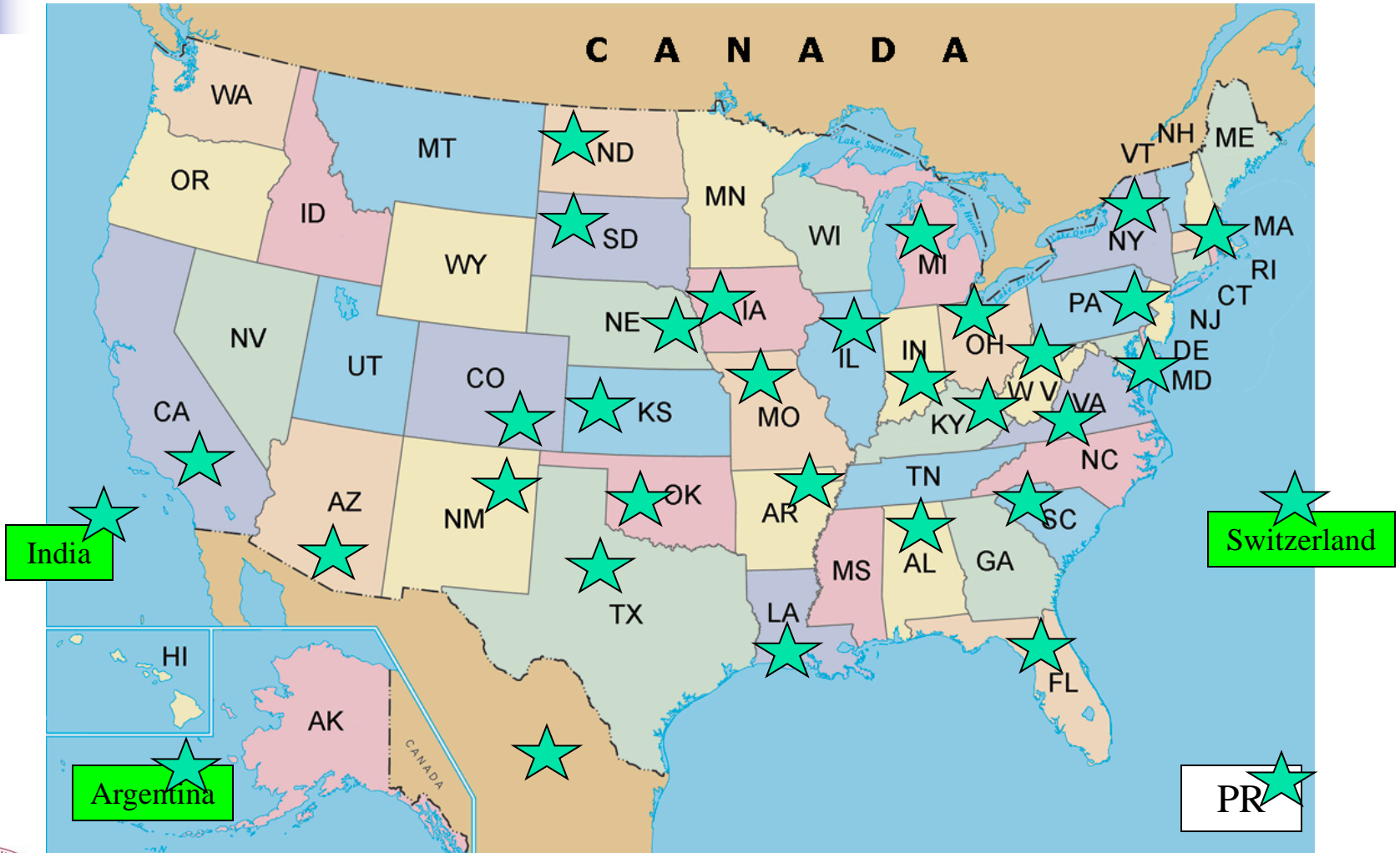
SiPE Workshop Participants 2007



OSCER State of the Center Address
Wednesday October 6 2010



SiPE Workshop Participants 2009



OSCER State of the Center Address
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What Does OSCER Do? Rounds



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



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OSCER's Education Strategy

- “Supercomputing in Plain English” workshops
- Supercomputing tours (like last night)
- Rounds



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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: over 800 from 2001 to 2009



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Workshop Topics

- Overview
- The Storage Hierarchy
- Instruction Level Parallelism
- High Performance Compilers
- Shared Memory Parallelism
- Distributed Parallelism
- Applications & Types of Parallelism
- Multicore
- High Throughput Computing
- GPGPU: Number Crunching in Your Graphics Card
- Grab Bag: Scientific Libraries, I/O libraries, Visualization



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Teaching: Workshops

Supercomputing in Plain English: 746 so far!

- 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
- Spring 2009: 65 @ OU, 360 at over 70 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)
- SC08-09 Education Program Parallel Programming & Cluster Computing workshop Aug 2008, Aug 2009
- SC08 Education Program Parallel Programming & Cluster Computing daylong workshop at OK Supercomputing Symposium 2007, 2008, 2009
- **NEW! NCSI Intermediate Parallel & Cluster Computing workshop (summer 2010)**

... 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.



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Teaching: Academic Coursework

- CS: Empirical Methods (A. Fagg)
- CS: Scientific Computing (S. Lakshmiarahan)
- CS: Computer Networks & Distributed Processing (S. Lakshmiarahan)
- 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)
- Parallel Computing course at Cameron U (OK)
- Software Engineering course at Oklahoma City U
- **NEW! Bioinformatics course at U Tulsa (OK)**
- **NEW! Parallel Computing course at East Central U (OK)**
- **PLANNED: Chemistry course at Northeastern State U (OK), Fall 2010**
- **PLANNED: Chemistry course at Rogers State U (OK), Spring 2011**



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Teaching: Presentations & Tours

Courses at OU

1. Chem Engr: Industrial & Environmental Transport Processes (D. Papavassiliou)
2. Engineering Numerical Methods (U. Nollert)
3. Math: Advanced Numerical Methods (R. Landes)
4. Electrical Engr: Computational Bioengineering (T. Ibrahim)

Research Experience for Undergraduates at OU

1. Ind Engr: Metrology REU (T. Reed Rhoads)
2. Ind Engr: Human Technology Interaction Center REU (R. Shehab)
3. Meteorology REU (D. Zaras)

External

1. American Society of Mechanical Engineers, OKC Chapter
2. Association for Computing Machinery (ACM) Special Interest Group on Computer Science Education (SIGCSE) 2010
3. Oklahoma State Chamber of Commerce
4. National Educational Computing Conference 2006 (virtual tour via videoconference)
5. Norman (OK) Lions Club
6. Society for Information Technology & Teacher Education conference 2008, 2009, 2010
7. Axiom Conference on Applied Research in Information Technology 2008
8. Shawnee (OK) Lions Club
9. **NEW! Oklahoma Louis Stokes Alliance for Minority Participation (@ OSU) 2010 (Keynote)**

Other Universities

1. SUNY Binghamton (NY)
 2. Bradley University (IL)
 3. Cameron University (OK)
 4. **NEW! The Citadel (SC)**
 5. **NEW! College of the Muscogee Nation (OK)**
 6. DeVry University (OK)
 7. East Central University (OK)
 8. El Bosque University (Bogota Colombia)
 9. Southwestern University (TX)
 10. Langston University (OK)
 11. Louisiana State University
 12. Midwestern State University (TX)
 13. Northeastern Oklahoma State University
 14. Northwestern Oklahoma State University
 15. Oklahoma Baptist University
 16. Oklahoma City University
 17. Oklahoma State University x 2
 18. Oklahoma State University – OKC
 19. Oral Roberts University (OK) x 2
 20. St. Gregory's University (OK) x 2
 21. Southeastern Oklahoma State University x 2
 22. **NEW! Southern Nazarene University (OK)**
 23. Southwestern Oklahoma State University x 2
 24. Texas A&M-Commerce
 25. University of Arkansas Fayetteville
 26. University of Arkansas at Little Rock
 27. **NEW! University of Central Oklahoma**
 28. **NEW! University of Tulsa (OK)**
- High Schools and High School Programs
1. Oklahoma School of Science & Mathematics x 2
 2. Oklahoma Christian University's Opportunity Bytes Summer Academy
 3. Dept of Energy National Scholarship Finalists
 4. Ardmore High School (OK)

E M E W

OSCER State of the Center Address

Wednesday October 6 2010



What Does OSCER Do? Rounds



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



OSCER State of the Center Address
Wednesday October 6 2010



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 State of the Center Address
Wednesday October 6 2010





OSCER Research



OSCER Research

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



OSCER State of the Center Address
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What Does OSCER Do? Rounds



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



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ADVANCING RESEARCH... CREATING SOLUTIONS

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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: 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.



OSCER State of the Center Address
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Has now evolved into supercomputing help sessions, where many different groups work at the same time.



OSCER State of the Center Address
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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.



OSCER State of the Center Address
Wednesday October 6 2010





Spring Storm Experiment 2010

As usual, OSCER played a major role in the Spring Storm Experiment, which involved the Center for Analysis & Prediction of Storms, the NOAA Storm Prediction Center, Oak Ridge National Laboratory, 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 20-60% of Sooner every day for 3 months.



OSCER State of the Center Address
Wednesday October 6 2010





High Energy Physics

- Dzero project: #1 most productive US academic site, 2010
- ATLAS project: #5 most productive US academic site, 2010



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External Research Grants

1. H. Neeman, D. Brunson (OSU), J. Deaton (OneNet), J. He (Noble Foundation), D. Schoenefeld (TU), J. Snow (Langston U), M. Strauss (OU), X. Xiao (OU), M. Xue (OU), "Oklahoma Optical Initiative," NSF, \$1.17M
2. H. Neeman, M. Jensen, M. Strauss, X. Xiao, M. Xue, E. Baron, K. Dresback, R. Kolar, A. McGovern, R. Palmer, D. Papavassiliou, H. Severini, P. Skubic, T. Trafalis, M. Wenger, R. Wheeler (Duquesne U), "MRI: Acquisition of Extensible Petascale Storage for Data Intensive Research," NSF, \$793K
3. D. Resasco, J. Harwell, F. Jentoft, K. Gasem, S. Wang, "Center for Interfacial Reaction Engineering (CIRE)," DOE EPSCoR, \$3M (\$2M OU)
4. P. Skubic, M. Strauss, B. Abbott, P. Gutierrez, "Experimental Physics Investigations Using Colliding Beam Detectors at Fermilab and the Large Hadron Collider (LHC) (TASK A) 2010-2013 Renewal," DOE, \$2.8M
5. R. Palmer, Y. Zhang, G. Zhang, T. Yu, M. Yeary, Y. Hong, J. Crain, P. Chilson, "Next Generation Phased Array," NSSL, \$2M
6. P. Skubic, M. Strauss, B. Abbott, P. Gutierrez, "Experimental Physics Investigations Using Colliding Beam Detectors at Fermilab and the Large Hadron Collider (LHC) (TASK A) 2010-2013 Renewal-Revision," DOE, \$1.52M
7. D. Cole, Alberto Striolo, "Structure and Dynamics of Earth Materials, Interfaces and Reactions," DOE, \$1.5M (\$90K OU)
8. R. Sigal, F. Civan, D. Devegowda, "Simulation of Shale Gas Reservoirs Incorporating the Correct Physics of Capillarity and Fluid Transport," Research Partnership to Secure Energy for America (RPSEA), \$1.05M
9. M. Biggerstaff, J. Straka, L. Wicker, Zrnica, Zahari, "MRI Development of C-Band Mobile Polarimetric Weather Radars," NSF, \$989K (\$439K OU)
10. D. Resasco, D. Papavassiliou et al, "Carbon Nanotube Technology Center," DOE, \$925K
11. M. Saha, D. Papavassiliou, A. Striolo, K. Mullen, B. Grady, C. Altan, D. Resasco, "Experimental and theoretical studies of carbon nanotube hierarchical structures in multifunctional polymer composites," DoD-EPSCoR, \$897K
12. E. Mansell, J. Straka, C. Ziegler, D. MacGorman, "Numerical modeling studies of storm electrification and lightning," NSF, \$817K
13. E. Rasmussen, J. Straka, K. Kanak, "Collaborative Research: Challenges in understanding tornadogenesis and associated phenomena, \$755K (\$489K OU)
14. J. Straka, K. Kanak, "Challenges in tornadogenesis and associated phenomena," NSF, \$584K

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\$186M total, \$99M to OU

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External Research Grants (cont'd)

15. M. Xue, F. Kong, "Advanced Multi-Moment Microphysics for Precipitation and Tropical Cyclone Forecast Improvement with COAMPS," ONR, \$592K
16. J. Straka, K. Kanak, "Collaborative Research: Challenges in Understanding Tornadoogenesis and Associated Phenomena," NSF, \$515K
17. D. MacGorman, E. Mansell, C. Ziegler, A. Fierro, M. Xue, "Techniques for Assimilating Geostationary Lightning Mapper Data and Assessment of the Resulting Impact on Forecasts," NOAA, \$415K
18. M. Xue, F. Kong, K. Brewster, X. Wang, "A Partnership to Develop, Conduct, and Evaluate Realtime High-Resolution Ensemble and Deterministic Forecasts for Convective-scale Hazardous Weather: Moving to the Next Level," NOAA CSTAR, \$375K
19. M. Xue, K. Brewster, J. Gao, X. Wang, "Advanced Data Assimilation and Prediction Research for Convective-Scale 'Warn-on-Forecast,'" \$375K, NOAA
20. X. Wang, "Improving satellite radiance data assimilation using a hybrid ensemble-Gridpoint Statistical Interpolation (GSI) method for global numerical weather prediction," NASA, \$334K
21. X. Wang, M. Xue, "Improving NOAA operational global numerical weather prediction using a hybrid-ensemble Kalman filter data assimilation and ensemble forecast system," NOAA, \$322K
22. D. Resasco, D. Papavassiliou et al, "Interfacially active SWNT/silica nanohybrids," Advanced Energy Consortium (AEC), \$333K
23. D. Oliver, "Data analysis and inversion for mobile nanosensors," AEC, \$320K
24. R. Palmer, T. Yu, G. Zhang, M. Yearly, P. Chilson, Y. Zhang, J. Crain, "Advancements in Phased Array Weather Radar Research at OU," NOAA National Severe Storms Laboratory (NSSL), \$270K
25. A. Striolo, "The Emergent Behavior of Solid Nanoparticles at Oil-Water Interfaces: A Multi-Scale Thermodynamic Approach to Enable Bio-Oil Upgrade," NSF, \$238K
26. M. Xue, K. Brewster, F. Kong, "Development of a Short-Range Realtime Analysis and Forecasting System based on the ARPS for Taiwan Region," NOAA, \$200K
27. J. Straka, K. Kanak, "Formative dynamics of the mammatus clouds in thunderstorm cirrus," NSF, \$318K
28. M. Yearly, C. Tang, "Computationally Efficient Linear Transforms for Remote Sensing Systems," NSF, \$299K
29. A. Striolo, "Probing regular solution theory for mixed amphoteric/ionic surfactant systems by molecular dynamics simulations," ACS, \$100K

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External Research Grants (cont'd)

30. K. Brewster, M. Xue, F. Kong, meteorology project, \$211K
31. M. Xue, meteorology project, \$120K
32. A. McGovern, "Learning to guide search in large state spaces," IBM DARPA, \$95K
33. J. Straka, K. Kanak, "Supplement: Challenges in tornadogenesis and associated phenomena (VORTEX2)," NSF, \$87K
34. F. Kong, M. Xue, "Establishment of an Experimental Real-Time Short-Term Storm Prediction System for Shenzhen Meteorological Bureau," \$58K
35. J. Straka, "Improved Understanding/Prediction of Severe Convective Storms and Attendant Phenomena through Advanced Numerical Simulation," NSF, \$58K
36. M. Xue, "Assimilation of NEXRAD Radial Winds in a Regional Mesoscale Model," Miss State U, \$79K
37. J. Cruz, R. Todd, "Medium-Density Parity-Check Codes for Tape Systems," INSIC, \$36K
38. M. Xue, D. Stensrud, J. Gao, "Advancing Warn on Forecast – Storm-scale Analysis of Vortex 2 Thunderstorms," NSSL, \$70K
39. P. Attar, "High-Fidelity Computational Aeroelastic Solver Research," Ohio Aerospace Institute, \$60K
40. J. Straka, K. Kanak, "Development of Unmanned Aircraft System for Research in a Severe Storm Environment and Deployment within the VORTEX 2," NSF, \$44K
41. J. Cruz, "Equalization, Detection, and Coding Algorithms for Bit Patterned Media Recording Channels," International Storage Industry Consortium (INSIC), \$35K
42. J. Cruz, R. Todd, "Signal Processing for Magnetic Recording Channels," private company, \$30K
43. P. Attar, P. Vedula, "Deterministic and Statistical Characterization of the Impact of Control Surface Freeplay on Flutter and Limit-Cycle Oscillation (LCO) using Efficient Computational Modeling," Advanced Dynamics, \$30K
44. P. Attar, P. Vedula, "Novel Reduced Order in time Models for Problems in Nonlinear Aeroelasticity," Advanced Dynamics, \$29K
45. F. Carr, J. Straka, "Severe storm research," Jonathon Merage Foundation, \$21K
46. F. Carr, J. Straka, "Severe storm research," Jonathon Merage Foundation, \$20K

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External Research Grants (cont'd)

47. A. Striolo, "Electrolytes at Solid-Water Interfaces: Theoretical Studies for Practical Applications," DOE EPSCoR, \$450K
48. A. Striolo, Saha, "Experimental and Theoretical Studies of Carbon Nanotube Hierarchical Structures in Multifunctional Polymer Composites," DOD EPSCoR, \$450K
49. D. Cole (ORNL), A. Striolo, "Structure and Dynamics of Earth Materials, Interfaces and Reactions," DOE, \$1.5M (\$75K OU)
50. D. Papavassiliou, A. Striolo, "Effects of Hydrophobicity-Induced Wall Slip on Turbulence Drag and Turbulence Structure," NSF, \$230K
51. A. Striolo, D. Resasco, U. Nollert, "Understanding the Interactions between Carbon Nanotubes and Cellular Membranes," NSF, \$380K
52. M. Xue, Y. Hong, X. Hu (GSU), "Integrated Weather and Wildfire Simulation and Optimization for Wildfire Management," NSF, \$997K (\$483K OU)
53. Y. Hong, "Next Generation QPE: Toward a Multi-Sensor Approach for Integration of Radar, Satellite, and Surface Observations to Produce Very High-resolution Precipitation Data," NOAA/OAR/NSSL via CIMMS, \$83K
54. R. Palmer, Y. Hong, "Phased Array Technology for Weather Radar Applications," NOAA/OAR/NSSL via CIMMS, \$426K
55. Y. Hong, Baski (OSU), "Proactive approach to transportation resource allocation under severe winter weather emergencies," OK-DOT/OTC, \$261K (\$101K OU)
56. R. Palmer, Y. Hong, "Atmospheric Observations using PhasedArray Technology," \$340K
57. Y. Hong, "Toward Improved Flood Prediction and Risk Mitigation: Capacity Building for Africa," NASA, \$87K
58. Y. Hong, "Improving NASA Global Hazard System and Implementing SERVIR-Africa," NASA, \$272K
59. Y. Hong, "Link SERVIR-Africa Work to NASA Land Information System: Workshop Training and Data Assimilation of GRACE to NASA-OU Hydrologic Model," NASA, \$10K
60. R. Adler (NASA), Y. Hong, "Global Hazard (Flood-Landslide) Decision-Support System," NASA, \$900K
61. S. Schroeder, "CAREER: Advancing Viral RNA Structure Prediction," NSF, \$750K

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External Research Grants (cont'd)

62. P. Attar, "High Fidelity Computational Aeroelastic Analysis of a Flexible Membrane Airfoil Undergoing Dynamic Motion," Ohio Aerospace Institute, \$35K
63. P. Attar, "Computational Model Development and Experimental Validation Measurements for Membrane-Batten Wing" Flexible Membrane Airfoil Undergoing Dynamic Motion," Ohio Aerospace Institute, \$43K
64. K. Droegemeier, F. Kong, P. Attar, "A Partnership to Develop, Conduct, and Evaluate Realtime High-Resolution Ensemble and Deterministic Forecasts for Convective-scale Hazardous Weather," NOAA, \$375K
65. M. Xue, G. Zhang, K. Brewster, F. Kong, "Prediction and Predictability of Tropical Cyclones over Oceanic and Coastal Regions and Advanced Assimilation of Radar and Satellite Data for the Navy Coupled Ocean-Atmosphere Mesoscale Prediction System," ONR/DOD EPSCoR, \$454K; OK Board of Regents \$100K
66. S. Ahalt, A. Apon, D. Lifka, H. Neeman, "NSF Workshop High Performance Computing Center Sustainability," NSF, \$49K (\$0 OU)
67. Y. Luo, S. Lakshmivarahan, "Development of a Data Assimilation Capability towards Ecological Forecasting in a Data-Rich Era," NSF, \$1.08M
68. Y. Luo, D. Schimmel (NEON), J. Clark (Duke U.), Kiona Ogle (U. Wyoming), S. LaDeau (Cary Institute of Ecosystem Study), "RCN: Forecasts Of Resource and Environmental Changes: Data Assimilation Science and Technology (FORECAST)," NSF, \$500K
69. J. Straka, K. Kanak, Davies-Jones, H. Neeman, "Challenges in understanding tornadogenesis and associated phenomena," NSF, \$854K
70. P. Risser et al, "A cyberCommons for Ecological Forecasting," NSF, \$6M (\$2.78M OU)
71. M. Xue, X. Wang, X. Li (OSU), R. Barnes, S. Sanielevici (PSC), H. Neeman, "Enabling Petascale Ensemble-Based Data Assimilation for the Numerical Analysis and Prediction of High-Impact Weather," NSF, \$1.2M (\$902K OU)
72. P. Skubic, B. Abbott, P. Gutierrez, M. Strauss, "ATLAS Southwest Tier 2 Computing Center," NSF, \$600K/year (\$60K/year OU)
73. Y. Hong, "Evaluation of NASA Global Hazard System," NASA, \$45K

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External Research Grants (cont'd)

74. J Wicksted, F. Waxman et al, "Building Oklahoma's Leadership Role in Cellulosic Bioenergy," NSF EPSCoR, \$15M (\$5.7M OU)
75. D.S. Oliver, software, \$16.7M
76. K.K. Muraleetharan, G. Miller, and A. Cerato, "Understanding and Improving the Seismic Behavior of Pile Foundations in Soft Clays," NSF, \$1.15M (\$500K OU)
77. K. Droegemeier, F. Kong, "Multisensor Studies of Precipitation for Model Verification and Data Assimilation," U Minn, (\$7K OU)
78. K. Droegemeier, M. Xue, F. Kong, "Observing System Simulation Experiments for Airborne Weather Sensors," HRL, (\$33K OU)
79. M. Nollert, Scholarship, FD-OMRF, \$12K
80. R. Sigal, R. Philp, C. Rai., S. Shah, R. Slatt, C. Sondergeld, D. Zhang, energy company, \$1.9M
81. B. Grady, D. Schmidtke, A. Striolo, A. Cheville, D. Teeters, "Polymer Nanostructures on Solid Surfaces," \$208K (\$125K OU)
82. T. Conway, "E. coli Model Organism Resource," UN-Purdue, (\$685K OU)
83. R. Kolar, "Storm Surge Modeling in SE Louisiana - 2006," ARCADIS, (\$37K OU)
84. D. Cole (ORNL), A. Striolo, "Rates and Mechanisms of Mineral-Fluid Interactions at the Nanoscale," DOE, \$1.65M (total), (\$55K OU)
85. R. Kolar, "A Prototype Operational Modeling System for Waves, Coastal Currents, Inundation and Hydrologic Flooding for Eastern North Carolina," UN-UNC-CH, (\$209K OU)
86. R. Kolar, "A Coupled Regional-Coastal Ocean Model: HYCOM/CG-ADCIRC," DOD-NRL, (\$333K OU)
87. M. Xue, "Contribution to WRF Model Development by the Center for Analysis and Prediction of Storms," DOC-NOAA, \$821K
88. K. Marfurt, "Improving Geologic and Engineering Models of Midcontinent Fracture and Karst Modified Reservoirs Using 3-D Seismic Attributes," UKCRINC, (\$61K OU)
89. P. Attar, P. Vedula, "Novel, Optimal, Physics-based Reduced Order Models for Nonlinear Aeroelasticity," Advanced Dynamics, \$49K
90. S. Dhall, "Autonomous Data Partitioning using Data Mining for High Performance Computing," NSF, (\$125K OU)

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External Research Grants (cont'd)

91. M. Xue, K. Brewster, J. Gao, "Ensemble-based Data Assimilation for Tropical Storms, and Realtime 3DVAR Analysis for Initial Proof of 'Warn-on-Forecast' Concept: Collaborative Research between CAPS and NSSL," DOC-NOAA, \$100,000
92. M. Xue, "Contribution to Model Development and Enhancement Research Team by the Center for Analysis and Prediction of Storms," DOC-NOAA, \$180,000
93. M. Xue, K. Brewster, "Ensemble-based Data Assimilation for Convective Storms and Hurricanes," DOC-NOAA, \$100,000
94. S. Schroeder, "Discovering Satellite Tobacco Mosaic Virus Structure," OCAST, \$85K
95. S. Schroeder, "Computational Advances Toward Predicting Encapsidated Viral RNA Structure," Pharmaceutical Research and Manufacturer's Association of America, \$60K
96. R. Kolar, "Outer Boundary Forcing for Texas Coastal Models," Texas Water Development Board, \$20K
97. K. Milton, "Collaborative Research: Quantum Vacuum Energy", NSF, \$250K
98. A. McGovern, "Developing Spatiotemporal Relational Models to Anticipate Tornado Formation," NSF, \$500K
99. Y. Kogan, "Midlatitude Aerosol-Cloud-Radiation Feedbacks in Marine Boundary Layer Clouds", ONR, \$638K
100. J. Straka, K. Kanak, Davies-Jones, "Challenges in understanding tornadogenesis and associated phenomena," NSF, \$854K (total), \$584K (OU)
101. Y. Hong, "Improvement of the NASA Global Hazard System and Implement Server-Africa," NASA, \$272K
102. 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
103. A. Striolo, "Electrolytes at Solid-Water Interfaces: Theoretical Studies for Practical Applications," OSRHE Nanotechnology, \$15K
104. D. Papavassiliou, "Turbulent transport in non-homogeneous turbulence," NSF, \$320K

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External Research Grants (cont'd)

105. K. Droegemeier et al., "Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere," NSF, \$17M (total), \$5.6M (OU)
106. K. Droegemeier et al., "Linked Environments for Atmospheric Discovery (LEAD)," NSF, \$11.25M (total), \$2.5M (OU)
107. M. Strauss, P. Skubic et al., "Oklahoma Center for High Energy Physics", DOE EPSCoR, \$3.4M (total), \$1.6M (OU)
108. M. Richman, A. White, V. Lakshmanan, V. DeBrunner, P. Skubic, "Real Time Mining of Integrated Weather Data," NSF, \$950K
109. D. Weber, K. Droegemeier, H. Neeman, "Modeling Environment for Atmospheric Discovery," NCSA, \$435K
110. H. Neeman, K. Droegemeier, K. Mish, D. Papavassiliou, P. Skubic, "Acquisition of an Itanium Cluster for Grid Computing," NSF, \$340K
111. J. Levit, D. Ebert (Purdue), C. Hansen (U Utah), "Advanced Weather Data Visualization," NSF, \$300K
112. D. Papavassiliou, "Turbulent Transport in Wall Turbulence," NSF, \$165K
113. L. Lee, J. Mullen (Worcester Polytechnic), H. Neeman, G.K. Newman, "Integration of High Performance Computing in Nanotechnology," NSF, \$400K
114. R. Wheeler, "Principal mode analysis and its application to polypeptide vibrations," NSF, \$385K
115. R. Kolar, J. Antonio, S. Dhall, S. Lakshmivaran, "A Parallel, Baroclinic 3D Shallow Water Model," DoD - DEPSCoR (via ONR), \$312K
116. R. Luettich (UNC), R. Kolar, B. Vieux, J. Gourley, "The Center for Natural Disasters, Coastal Infrastructure, and Emergency Management," DHS, \$699K
117. D. Papavassiliou, M. Zaman, H. Neeman, "Integrated, Scalable MBS for Flow Through Porous Media," NSF, \$150K
118. Y. Wang, P. Mukherjee, "Wavelet based analysis of WMAP data," NASA, \$150K
119. E. Mansell, C. L. Ziegler, J. M. Straka, D. R. MacGorman, "Numerical modeling studies of storm electrification and lightning," \$605K

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External Research Grants (cont'd)

120. 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
121. R. Wheeler, T. Click, "National Institutes of Health/Predocorral Fellowships for Students with Disabilities," NIH/NIGMS, \$80K
122. K. Pathasarathy, D. Papavassiliou, L. Lee, G. Newman, "Drag reduction using surface-attached polymer chains and nanotubes," ONR, \$730K
123. D. Papavassiliou, "Turbulent transport in non-homogeneous turbulence," NSF, \$320K
124. C. Doswell, D. Weber, H. Neeman, "A Study of Moist Deep Convection: Generation of Multiple Updrafts in Association with Mesoscale Forcing," NSF, \$430K
125. D. Papavassiliou, "Melt-Blowing: Advance modeling and experimental verification," NSF, \$321K
126. R. Kol,ar et al., "A Coupled Hydrodynamic/Hydrologic Model with Adaptive Gridding," ONR, \$595K
127. D. Papavassiliou, "Scalar Transport in Porous Media," ACS-PRF, \$80K
128. 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.
129. J. Gao, K. Droegemeier, M. Xue, "On the Optimal Use of WSR-88D Doppler Radar Data for Variational Storm-Scale Data Assimilation," NSF, \$600K.
130. K. Mish, K. Muraleetharan, "Computational Modeling of Blast Loading on Bridges," OTC, \$125K
131. V. DeBrunner, L. DeBrunner, D. Baldwin, K. Mish, "Intelligent Bridge System," FHWA, \$3M
132. D. Papavassiliou, "Scalar Transport in Porous Media," ACS-PRF, \$80K
133. Y. Wang, P. Mukherjee, "Wavelet based analysis of WMAP data," NASA, \$150K
134. R. Wheeler et al., "Testing new methods for structure prediction and free energy calculations (Predocorral Fellowship for Students with Disabilities)," NIH/NIGMS, \$24K
135. L. White et al., "Modeling Studies in the Duke Forest Free-Air CO2 Enrichment (FACE) Program," DOE, \$730K

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External Research Grants (cont'd)

136. Neeman, Severini, "Cyberinfrastructure for Distributed Rapid Response to National Emergencies", NSF, \$132K
137. Neeman, Roe, Severini, Wu et al., "Cyberinfrastructure Education for Bioinformatics and Beyond," NSF, \$250K
138. K. Milton, C. Kao, "Non-perturbative Quantum Field Theory and Particle Theory Beyond the Standard Model," DOE, \$150K
139. J. Snow, "Oklahoma Center for High Energy Physics", DOE EPSCoR, \$3.4M (total), \$169K (LU)
140. M. Xue, F. Kong, "OSSE Experiments for airborne weather sensors," Boeing, \$90K
141. M. Xue, K. Brewster, J. Gao, A. Shapiro, "Storm-Scale Quantitative Precipitation Forecasting Using Advanced Data Assimilation Techniques: Methods, Impacts and Sensitivities," NSF, \$835K
142. Y. Kogan, D. Mechem, "Improvement in the cloud physics formulation in the U.S. Navy Coupled Ocean-Atmosphere Mesoscale Prediction System," ONR, \$889K
143. 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
144. 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
145. B. Wanner, T. Conway, et al., "Development of the www.EcoliCommunity.org Information Resource," NIH, \$1.5M (total), \$150K (OU)
146. 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
147. T. Ibrahim et al., "Micro-Neural Interface," OCAST, \$135K
148. J. Snow, "Langston University High Energy Physics," \$155K (LU)

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External Research Grants (cont'd)

149. L.M. Leslie, M.B. Richman, C. Doswell, "Detecting Synoptic-Scale Precursors Tornado Outbreaks," NSF, \$548K
150. L.M. Leslie, M.B. Richman, "Use of Kernel Methods in Data Selection and Thinning for Satellite Data Assimilation in NWP Models," NOAA, \$342K
151. 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
152. E. Chesnokov, "Fracture Prediction Methodology Based On Surface Seismic Data," Devon Energy, \$1M
153. E. Chesnokov, "Scenario of Fracture Event Development in the Barnett Shale (Laboratory Measurements and Theoretical Investigation)," Devon Energy, \$1.3M
154. M. Xue, K. Brewster, J. Gao, "Study of Tornado and Tornadoic Thunderstorm Dynamics and Predictability through High-Resolution Simulation, Prediction and Advanced Data Assimilation," NSF, \$780K
155. A. Striolo, "Heat Transfer in Graphene-Oil Nanocomposites: A Molecular Understanding to Overcome Practical Barriers." ACS Petroleum Research Fund, \$40K
156. D.V. Papavassiliou, "Turbulent Transport in Anisotropic Velocity Fields," NSF, \$292.5K
157. D. Oliver, software license grant, \$1.5M
158. R. Broughton et al, "Assembling the Eutelost Tree of Life – Addressing the Major Unresolved Problem in Vertebrate Phylogeny," NSF, \$3M (\$654K to OU)
159. A. Fagg, "Development of a Bidirectional CNS Interface or Robotic Control," NIH, \$600K
160. M. Xue, J. Gao, "An Investigation on the Importance of Environmental Variability to Storm-scale Radar Data Assimilation," NSSL, \$72K
161. JV. Sikavistsas and D.V. Papavassiliou , "Flow Effects on Porous Scaffolds for Tissue Regeneration," NSF, \$400K
162. P. Skubic, M. Strauss, et al., "Experimental Physics Investigations Using Colliding Beam Detectors at Fermilab and the LHC," DOE, \$503K

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External Funding Summary

- External research funding facilitated by OSCER (Fall 2001- Fall 2009): **\$186M total, \$99M to OU**
- Funded projects: **162**
- **102** OU faculty and staff in **19** academic departments and 2 other campus organizations (research centers etc)
- Comparison: Fiscal Year 2002-10 (July 2001 – June 2010):
OU Norman externally funded research expenditure: \$611M

Since being founded in fall of 2001, OSCER has enabled research projects comprising more than

1 / 7 of OU Norman's total externally funded research expenditure, with a 7-to-1 return on investment.



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Publications Facilitated by OSCER

- **124** publications facilitated by OSCER rounds/help sessions

- **2010: 9 papers** (so far)
- 2009: 9 papers
- 2008: 19
- 2007: 12
- 2006: 29
- 2005: 18
- 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.

- **472** publications facilitated by OSCER resources only

- **2010: 115 papers** (so far)
- 2009: 96 papers
- 2008: 81
- 2007: 60
- 2006: 56
- 2005: 45
- 2004: 15
- 2003: 4

Includes:

- 20 MS theses
- 19 PhD dissertations

TOTAL SO FAR: 596 publications

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



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OK Cyberinfrastructure Initiative

- Oklahoma submitted an NSF EPSCoR Research Infrastructure Proposal in Jan 2008 (\$15M).
- Starting that year, all NSF EPSCoR RII “Track 1” proposals HAD TO 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.



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NEW GRANT! NSF EPSCoR C2

Oklahoma has been awarded an NSF EPSCoR RII Intra-campus and Inter-campus Cyber Connectivity (C2) grant (PI Neeman), a collaboration among OU, OneNet and several other academic and nonprofit institutions, which will:

- upgrade the statewide ring from routed components to optical components, making it straightforward and affordable to provision dedicated “lambda” circuits within the state;
- upgrade several institutions’ connections;
- provide telepresence capability to institutions statewide;
- provide networking professionals to speak to data networks courses about what it’s like to do networking for a living.



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Oklahoma Optical Initiative

- Statewide ring goes from 3 sites (OU Norman as a sidebar) to 5 sites (OU Norman as co-equal).
- Replace routed mux/demuxes with Reconfigurable Optical Add Drop Modules, add 10 Gbps line cards, crossponders.

“OOI will transform Oklahoma’s existing research ring from a routed network to an optical network, leveraging existing infrastructure – chassis and fibers – while advancing optical switching components to a new level of technology, facilitating substantial improvement in reliability, robustness, availability and potentially bandwidth, as well as enabling the ability to provision dedicated lambdas straightforwardly and affordably.”



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Institutional Upgrades

- OU: Upgrade Sooner's connection to 10 Gbps (10X increase)
- OSU: Upgrade Pistol Pete's connection to 10 Gbps (10X)
- U Tulsa: Upgrade research networking to 1 Gbps (5X)
- Langston U: Upgrade High Energy Physics cluster to 10 Gbps (100X)
- Samuel Roberts Noble Foundation: upgrade to 250 Mbps (5X)
- Rural hubsites inherit routed mux/demuxes, replacing elderly SONET components.
 - Lawton: Cameron U, Comanche Nation College
 - Chickasha: U Science & Arts of Oklahoma
 - Tonkawa: Northern Oklahoma College



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Tribal Colleges

- We're working with Tribal Colleges and Tribal-serving institutions that have very low connectivity, to help improve their capabilities.
- We visited College of the Muscogee last week and are working with them on a plan involving their beautiful new building.
- We have plans to finalize a date with Comanche Nation College soon.
- We've gotten in touch with Pawnee Nation College.



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OK Networking Mentorship

The Oklahoma Networking Mentorship Program is sending networking professionals to universities, colleges, career techs and even a high school statewide.

These professionals will give talks on the practicalities of being a networking professional – what that career choice means day by day.

We'll also provide both live and virtual job shadowing opportunities – students can follow networking professionals around to see what their work looks like, either in person or via Twitter and Facebook.



ADVANCING RESEARCH



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OK Networking Mentorship

Already signed up for Fall 2010:

1. Cameron U (spring 2011)
2. Eastern Oklahoma County Technology Center
3. Eastern Oklahoma State College
4. Gordon Cooper Technology Center
5. Langston U
6. Oklahoma Christian U
7. Oklahoma City U
8. Oklahoma Panhandle State U
9. Oklahoma School of Science & Mathematics
10. Oklahoma State U
11. Oklahoma State U-Oklahoma City
12. U Central Oklahoma (spring 2011)
13. OU Norman
14. OU Tulsa



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NEW GRANT: Petascale Storage

OU has been awarded an NSF Major Research Instrumentation (MRI) grant (PI Neeman).

We'll purchase and deploy a combined disk/tape bulk storage archive:

- the NSF budget will pay for the hardware, software and warranties/maintenance for 3 years;
- OU cost share and institutional commitment will pay for space, power, cooling and labor, as well as maintenance after the 3 year project period;
- individual users (e.g., faculty across Oklahoma) will pay for the media (disk drives and tape cartridges).



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OK PetaStore Strategy

- Many media slots, few media.
- Most of the media the grant purchases will be allocated to the research projects in the proposal.
- Slots are available on a first come first serve basis.
- Under the Oklahoma Cyberinfrastructure Initiative, this is also true for academic institutions statewide (and also many non-academic institutions).



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MRI Research Projects

- **Numerical Prediction and Data Assimilation for Convection Storms, Tornadoes and Hurricanes**: Xue, Meteorology and Center for Analysis & Prediction of Storms (CAPS)
- **ATLAS Tier 2 High Energy Physics**: Strauss, Skubic, Severini, Physics & Astronomy, Oklahoma Center for High Energy Physics
- **Earth Observations for Biogeochemistry, Climate and Global Health**: Xiao, Botany & Microbiology, Center for Spatial Analysis
- **Adaption of Robust Kernel Methods to Geosciences**: Trafalis, Industrial Engr; Richman, Leslie, Meteorology
- **3D Synthetic Spectroscopy of Astrophysical Objects**: Baron, Physics & Astronomy
- **Credibility Assessment Research Initiative**: Jensen, Management Information Systems, Center for Applied Social Research

MRI Research Projects (cont'd)

- **Developing Spatiotemporal Relational Models to Anticipate Tornado Formation**: McGovern, Computer Science (CS), Interaction, Discovery, Exploration, Adaptation (IDEA) Lab
- **Coastal Hazards Modeling**: Kolar, Dresback, Civil Engineering & Environmental Science (CEES), Natural Hazards Center
- **High Resolution Polarimetric Radar Studies Using OU-PRIME Radar**: Palmer, Meteorology & Atmospheric Radar Research Center
- **Perceptual and cognitive capacity: Modeling Behavior and Neurophysiology**: Wenger, Psychology
- **Multiscale Transport in Micro- and Nano-structures**: Papavassiliou, Chemical, Biological & Materials Engr
- **Electron Transfer Cofactors and Charge Transport**: Wheeler, Chemistry & Biochemistry

NSF Data Management Plans

- Beginning mid-January 2011, **ALL** proposals to the NSF **MUST** have 2-page data management plans. (The plan could be an argument that no data management plan is needed).
- I'll be meeting with the Asst VP for Research to work on both boilerplate text describing the Oklahoma PetaStore, as well as strategizing how to assist researchers in constructing plans for metadata, provenance, etc.



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What a Bargain!

When you hand in a completed **EVALUATION FORM**, you'll get a beautiful new Wednesday October 6 2010 **T-SHIRT**, **FREE!**



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Thanks!

- Academic sponsors
 - Oklahoma EPSCoR
 - Great Plains Network
- Industry sponsors
 - Platinum: Intel
 - Gold: Cray, Dell, Hewlett Packard, IBM, Lumentate, Qlogic, Storage Assessments
 - Silver: Bright Computing, Mellanox, Panasas
 - Bronze: Advanced Clustering Technologies, Spectra Logic



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Thanks!

■ OU IT

- OU CIO/VPIT Dennis Aebersold
- Associate VPIT Loretta Early
- Symposium coordinator Michelle Wiginton
- Assistant to the CIO Pam Ketner
- OSCER Operations Team: Brandon George, Dave Akin, Brett Zimmerman, Josh Alexander
- Videographer Kevin Blake
- All of the OU IT folks who helped put this together

■ CCE Forum

- Deb Corley
- The whole Forum crew who helped put this together

■ Tutorial instructors: Charlie Peck, Andrew Fitz Gibbon



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Thanks!

1. Keynote speaker: Horst Simon, LBL
 - Plenary Speakers
 2. Jennifer M. Schopf, NSF
 3. Jan E. Odegard, Rice U
 4. Dan Stanzione, TACC
 5. Stephen Wheat, Intel
 - Breakout speakers
 6. Amy Apon, University of Arkansas
 7. Dana Brunson, Oklahoma State University
 8. Clay Carley, East Central U
 9. Annette D. Colbert-Latham, Visage Productions Inc.
 10. Dan Dawson, NOAA National Severe Storms Laboratory
 11. Kendra Dresback, OU
 12. Brent Eskridge, Southern Nazarene U
 13. Greg Clifford, Cray Inc.
 14. Dan Fraster, U Chicago
- Breakout speakers (continued)
 15. Blake T. Gonzales, Dell Inc.
 16. Roger Hall, U Arkansas Little Rock
 17. Kevin Heisler, Qlogic
 18. Deepthi Konatham, OU
 19. Allen LaBryer, OU
 20. Evan Lemley, University of Central Oklahoma
 21. Greg Monaco, Great Plains Network
 22. Jeff Pummill, University of Arkansas
 23. Steve Rovarino, Quantum Corp.
 24. Larry Sells, Oklahoma City U
 25. Horst Severini, OU
 26. Wade Vinson, Hewlett Packard
 27. Kent Winchell, IBM
 28. Charlie Zhao, Cameron U



Thanks!

To all of you for participating, and to those many of you who've shown us so much loyalty over the past 9 years.

NEXT YEAR: Oklahoma Supercomputing Symposium 2011
will be Tue Oct 11 – Wed Oct 12 2011.

Our tenth anniversary and our tenth Symposium – don't miss it!



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To Learn More About OSCER

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**Thanks for your
attention!**

Questions?