



NSF EPSCoR 21st National Conference 2009

Sustainability, Innovation, and EPSCoR
October 19–20, 2009

Panel 6 – Enabling Synergy

Debbie Crawford, Deputy Assistant Director for Computer and Information Science and Engineering (CISE), NSF

Ed Seidel, Interim Assistant Director for Mathematical and Physical Sciences, Director, Office of Cyberinfrastructure, NSF

Moderator: **Jim Bottum**, Vice Provost and Chief Information Officer, Clemson University



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Sustainability, Innovation, and EPSCoR
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Cyberinfrastructure Deployment: **Strategies and Issues**

Jim Bottum
Vice Provost and CIO
Clemson University

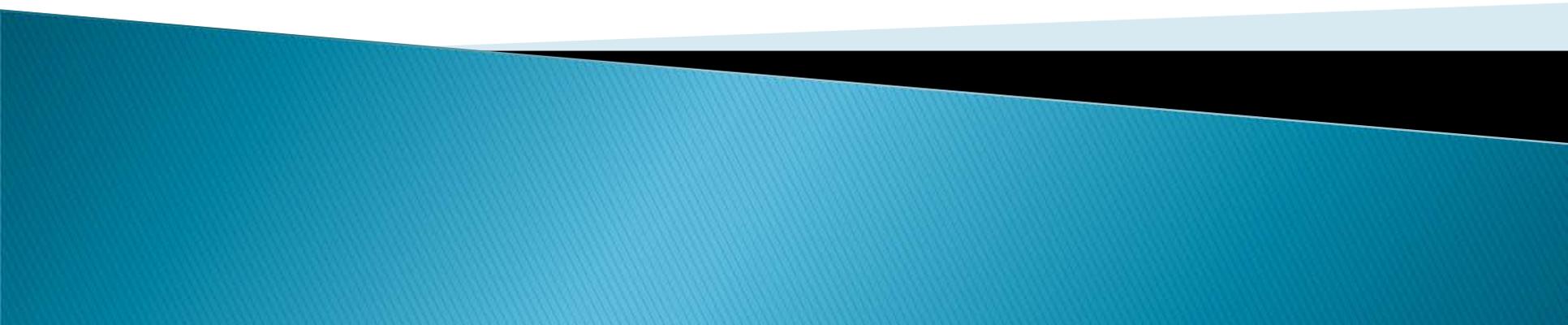
Two Parts

- ▶ CI in EPSCoR
- ▶ Developing a CI strategy
 - Infrastructure – resources
 - People
 - Programs
 - ROI and sustainability

CI in EPSCoR – A National View

Source: *EPSCoR Cyberinfrastructure Assessment*

Workshop, October 15–16, 2007, Lexington, Kentucky



Workshop Findings

- ▶ 97% of NSF's **OCI budget** to PIs in non-EPSCoR states
- ▶ 89% of NSF-sponsored **CI resources** (TeraGrid) to faculty in non-EPSCoR states
- ▶ Lack of optical fiber **networks** limits ability to access the nation's research and education infrastructure
- ▶ Lack of **human support** limits participation in cyber-enabled initiatives at the national team or investigator level

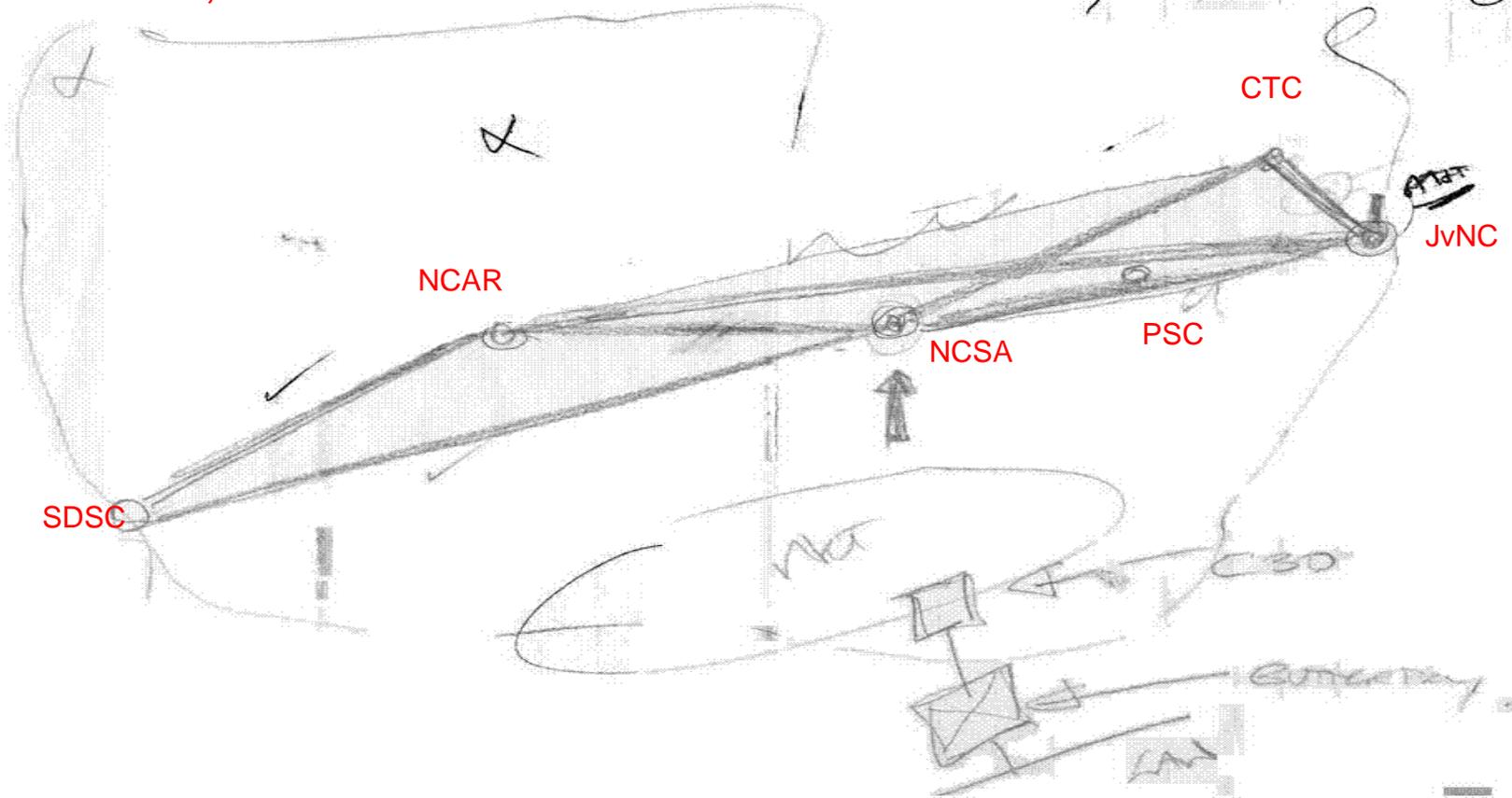
Research & Education Optical Networks (2008)



Networks – Where we were in 1986

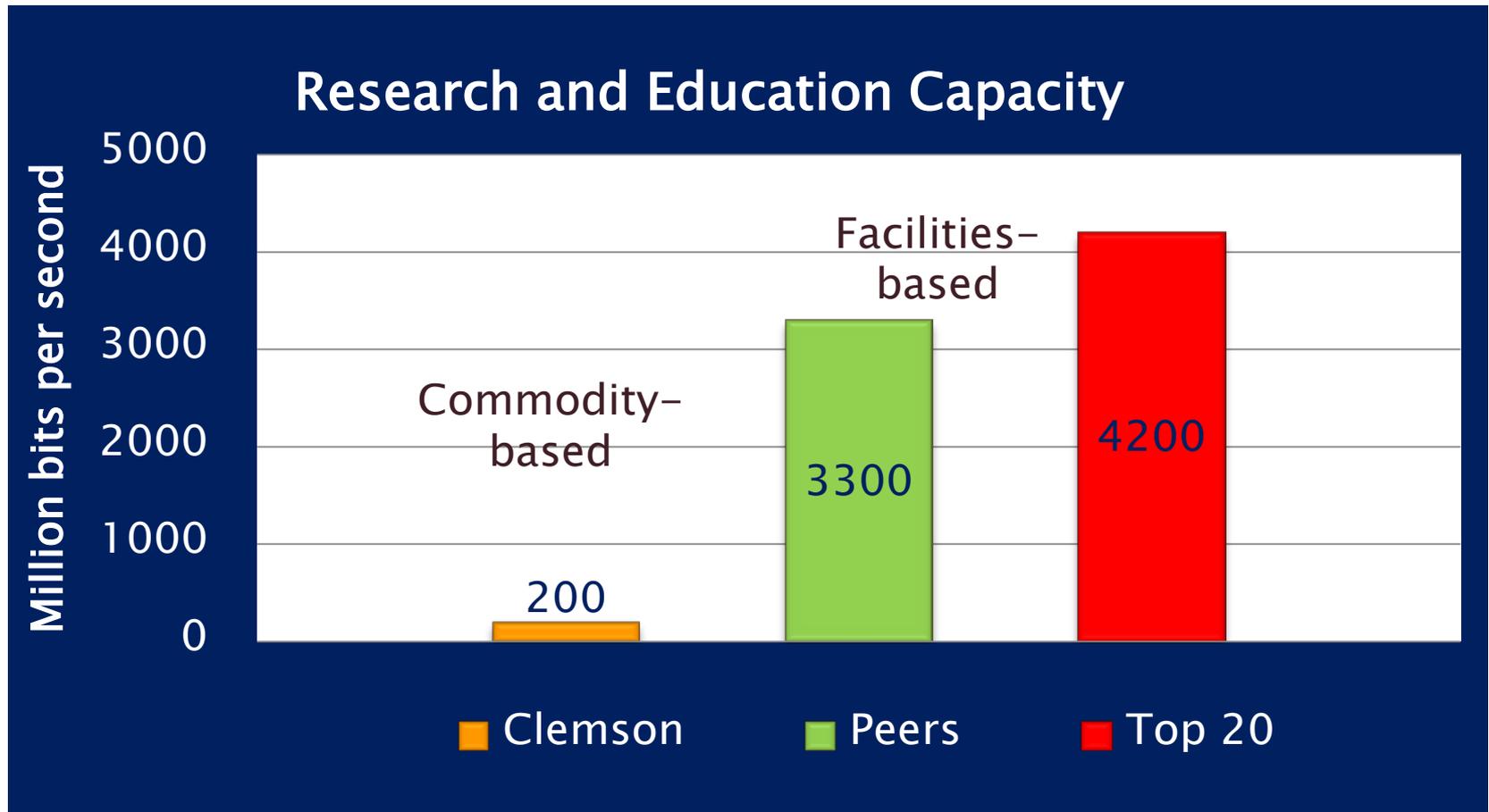
Original NSFNet design,
NCAR, Boulder, CO,
September 17, 1985

NSF
56KB MAP
9-17-85
09:35 AM



map of U.S.

Where some of us were in 2006



NSF RFP 06-599 High Performance Computing Operations
Clemson could not submit a proposal based on lack of appropriate connectivity

Network Evolution

- ▶ In the beginning....
 - Arpanet and other mission driven networks
 - NSFNet – connections program, research
 - Supported common infrastructure in 70s/80s
- ▶ Today.....
 - Confused landscape with Internet2, National Lambda Rail (NLR), regionals (RONs), telecomm industry issues
 - CISE – network research programs
 - EPSCOR/NTIA/OCI leverage next generation?
 - Broadband policy changes to help anchors

EPSCoR Research Infrastructure Improvement Program: Inter-Campus and Intra-Campus Cyber Connectivity (RII C2)

PROGRAM SOLICITATION
NSF 09-569



National Science Foundation

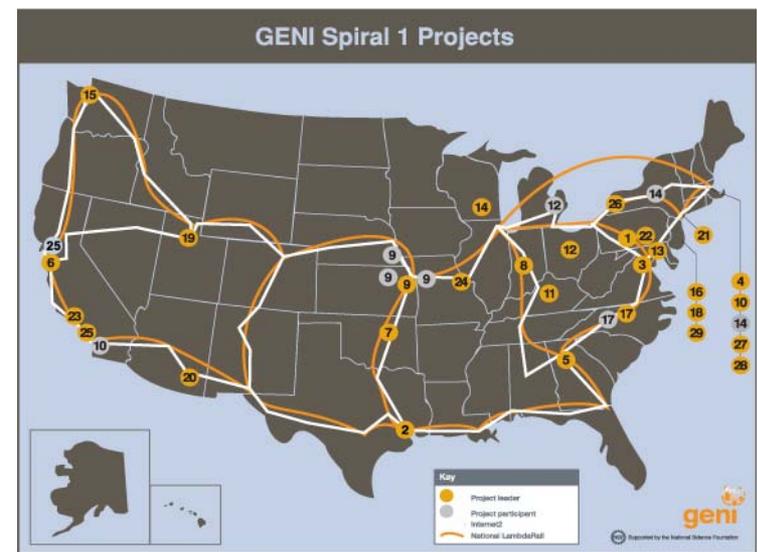
Office of Integrative Activities

Office of Experimental Program to Stimulate Competitive Research

Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

November 02, 2009

Important step in the right direction but not enough and needs additional NSF (OCI) participation



- NSF stopped funding network connectivity years ago
- GENI returns NSF to 'real' scale network research
- Clemson invested in network facilities to Atlanta and Charlotte – allows participation
- First contract just announced
- Regional Networks are key enablers of GENI participation
- EPSCoR funded state initiatives can leverage into GENI contracts (Educ community built NSFnet and Arpanet)
- Need focus on next generation networking

Observed CI Models*

- ▶ Centrally-driven (investment), academic, major research + HPC, large scale infrastructure – **Louisiana**
- ▶ Bottom up; people and research intensive; grid intensive (good national leverage) and outreach to research faculty focused – **Oklahoma**
- ▶ Regional with unique geographical issues; shows excellent leveraging to get infrastructure in place and deliver varied and quality services – **LARIAT**
- ▶ Taking it to the next level by integrating the business community and government into CI planning – **Kentucky**

** Personal workshop observations*

CyberInfrastructure (CI) In Louisiana

B. Ramu Ramachandran

State-wide IT initiative: \$25M – Gov. Mike Foster, 2001 - present

LONI - \$40M, Gov. Kathleen Blanco, 2004 - 2008

LONI - \$10M, Gov. Kathleen Blanco, 2006

LONI Institute - \$15M, BoR + Institutions, 2007

CyberTools RII - \$12M (NSF), 2007





Oklahoma Cyberinfrastructure

Presenter: Henry Neeman

Director, OU Supercomputing Center for Education & Research
University of Oklahoma

EPSCoR Cyberinfrastructure Meeting
Lexington, KY

October 15-16 2007





Beyond Lariat

Gwen Jacobs
Professor of Neuroscience
Asst. CIO and Director of Academic Computing
Montana State University

EPSCoR Cyberinfrastructure Workshop
Lexington, Kentucky
October 15–16, 2007

2009



A Public-Private Sector Collaboration to Improve the Quality of Life in Kentucky

A Strategic Framework

As we emerge from the second largest economic crisis in 100 years, we may be at a unique point in time where our states rethinking economies, business approaches and investments have at their doorstep a maturing set of information technologies that permeate all facets of our lives. These technologies, however, are not yet fully integrated in either a business or technical sense. And while opportunities abound, much work lies ahead in building new and strengthening existing partnerships, breaking down technology silos and reaching out to our citizens who may still live on the other side of the digital divide.



CI Investment Strategies

Sustainability: infrastructure investments + institutional commitment + integration + focus creates sustainable infrastructure and programs

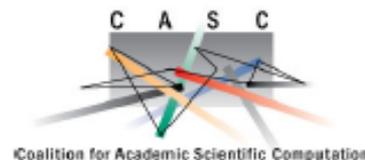
- ▶ Resources
 - Networks, computing, data handling, software infrastructure
- ▶ People
 - education, training, retraining, cross training
 - staff, students, communities
- ▶ Programs
 - Institutional commitment
 - Partnerships – in a competitive environment?
 - Determine “pre-competitive” or common space & jointly invest
 - Build on and use each others relative strengths

Developing a Coherent Cyberinfrastructure from Local Campus to National Facilities: Challenges and Strategies

A Workshop Report and Recommendations

EDUCAUSE Campus Cyberinfrastructure Working Group
and
Coalition for Academic Scientific Computation

February 2009

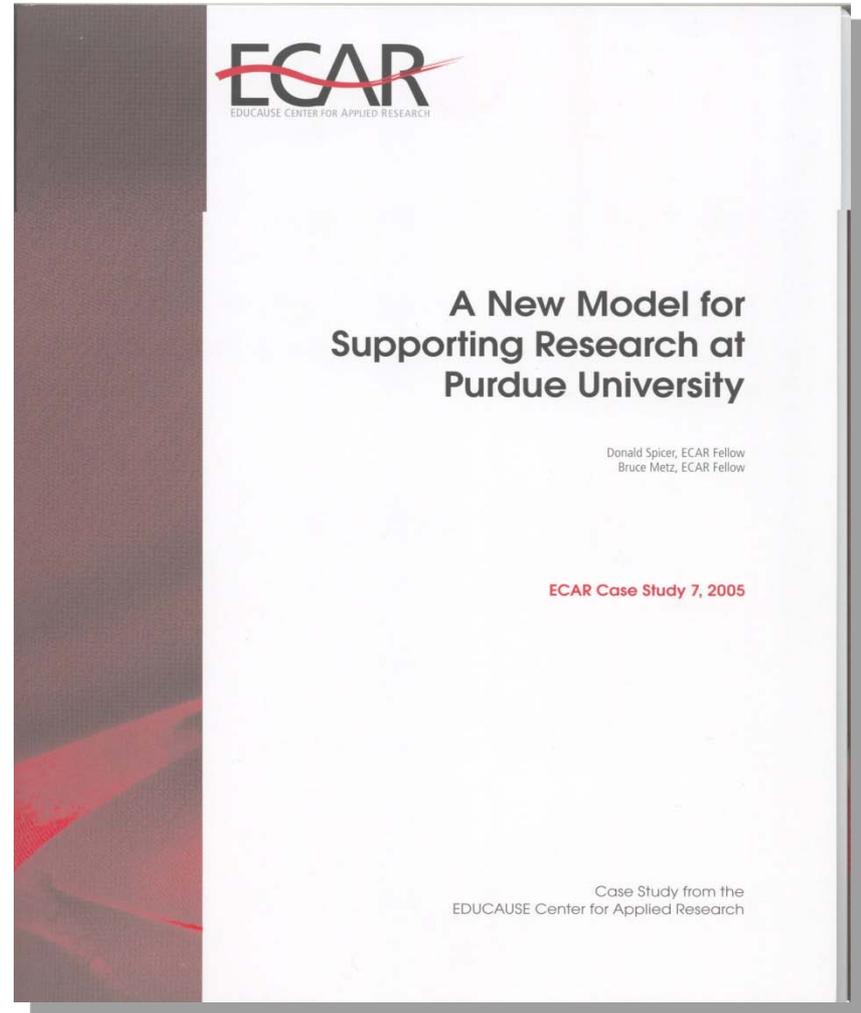


CASC-EDUCAUSE Report Conclusions

- ▶ Campuses must apportion limited resources across a spectrum of campus CI needs.
- ▶ Cross-disciplinary centers and campus-wide support structures encourage new paradigms for academic and research collaborations.
- ▶ The capacities of campus IT staff and resources to support CI are thin. Comprehensive CI requires a full spectrum of support and resources stretching from the campus up to national centers.
- ▶ Continued evolution of CI hinges on our better understanding and adapting to the complexity of this challenge.
- ▶ Leveraging CI resources and enabling new research and educational initiatives will depend on our ability to design and implement a coherent, coordinated strategic plan.

CI Strategy: Purdue

- 2001 Purdue emphasized targeted investment in IT (CI) plan
- Percentage of strategic plan funding targeted to CI investment
- State of Indiana was a co-investor



ROI – Purdue

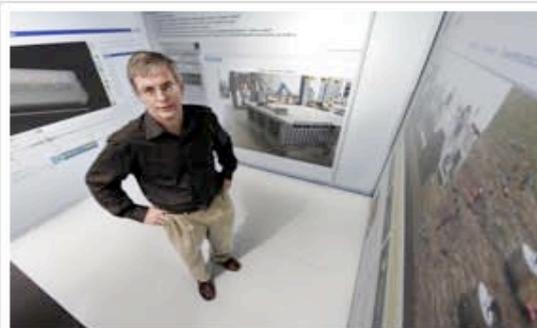


Purdue receives \$105 million award to lead national earthquake engineering network

September 10, 2009

Elizabeth Gardner

 Print Version



WEST LAFAYETTE, Ind. - Advancing research and education to reduce the devastation and loss of human life from earthquakes and tsunamis is the goal of a new center at Purdue University.

The National Science Foundation awarded \$105 million to a Purdue-led team to spearhead a center that will serve as headquarters for the operations of the George E. Brown, Jr. Network for

Featured News

- Apollo 13 astronaut to speak at Purdue
- Purdue plant breeder, geneticist receives World Food Prize
- Deborah Butterfield bronze horse sculpture to be installed at Purdue
- New program at Purdue aims to build computer science skills of future high school teachers
- 'Purdue's Place in Space: From the Midwest to the Moon' goes online
- Best-selling author, biologist to speak at Purdue sustainability event
- Purdue participates in Oct. 12-16 program to waive application fee

[More News »](#)

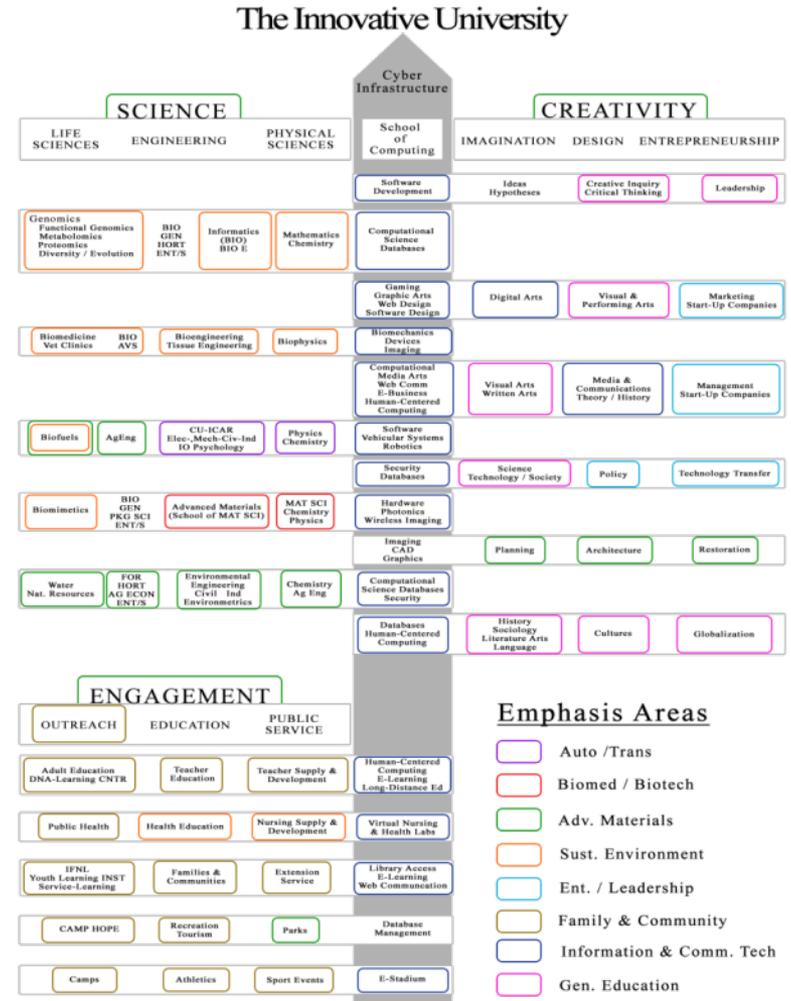
Follow Us



Clemson CI Strategy

“Cyberinfrastructure is the primary backbone that ties together innovation in research, instruction, and service to elevate Clemson to the Top 20”

Dori Helms
Provost



Facilitating understanding adoption and collaboration

Over 200 Faculty
Base of 1000

Faculty – Staff
Task Force

2 campus wide
funded projects



May 19 - 21, 2008
at **Clemson University**

Cyberinfrastructure Days

The Madren Conference Center & Inn

conference | sign up

Home
CI Seed Grant Program
Conference Photos
Cost
Evaluation
Message from CIO
MessageGrid
Objectives & Benefits
Participants
Podcast
Posters
Schedule / Agenda
Speakers
Sponsors
Contact Us

Cyberinfrastructure Conference

A two-day forum to explore innovative ways to integrate information technology into teaching, research and outreach programs.

Information technology, or Cyberinfrastructure (CI), has become a key enabler for teaching, distance education, scholarly research, collaboration and learning technologies. Faculty, students, researchers and IT professionals are becoming increasingly reliant on a mixture of communications hardware and software, networking, high-performance computing and storage, virtual organizations and experienced information technology support professionals.

However, CI is not just about the technology. All academic disciplines are now engaging new technologies and services to bridge gaps in understanding and enhance the collaborative relationships on campus and around the world. The CI Days Conference will help develop a greater understanding of cyberinfrastructure and build alliances among teaching faculty, researchers, academic and IT partners, national experts in cyberinfrastructure and providers of CI services.

do you dream of...
register online
accommodations
James F. Morfin Inn
The CI Hotel
The Madren Conference Center

our national partners



helpful info

Presentations

Related Links

Google map to Conference Center

understanding Cyberinfrastructure

Starting a 5 minute conversation about CI | 7 things you should know about CI | NSF's 21st Century Vision for Cyberinfrastructure | Developing & Extending a CI Model | More...

Web Site Information | Contact Clemson | University Index | ABCDEFGHIJKLMNOPQRSTUVWXYZ

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Shared Research Infrastructure

Condominium computing

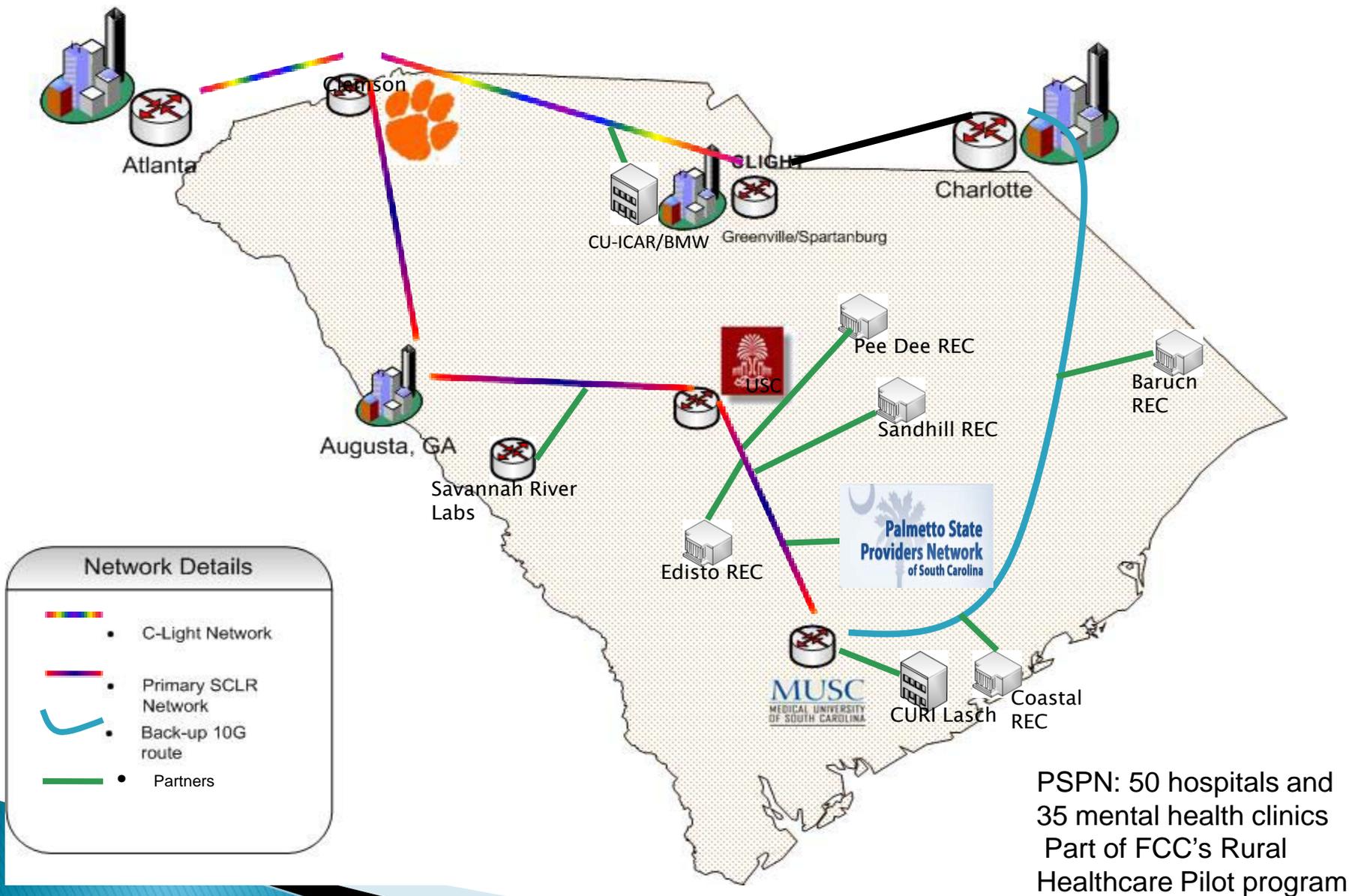
- sponsored research, departments and central IT
- frees departmental resources (physical and human)
- provides on demand access, professional support, security
- aggregates compute power for grand challenges and the greater good



Investment for Growth



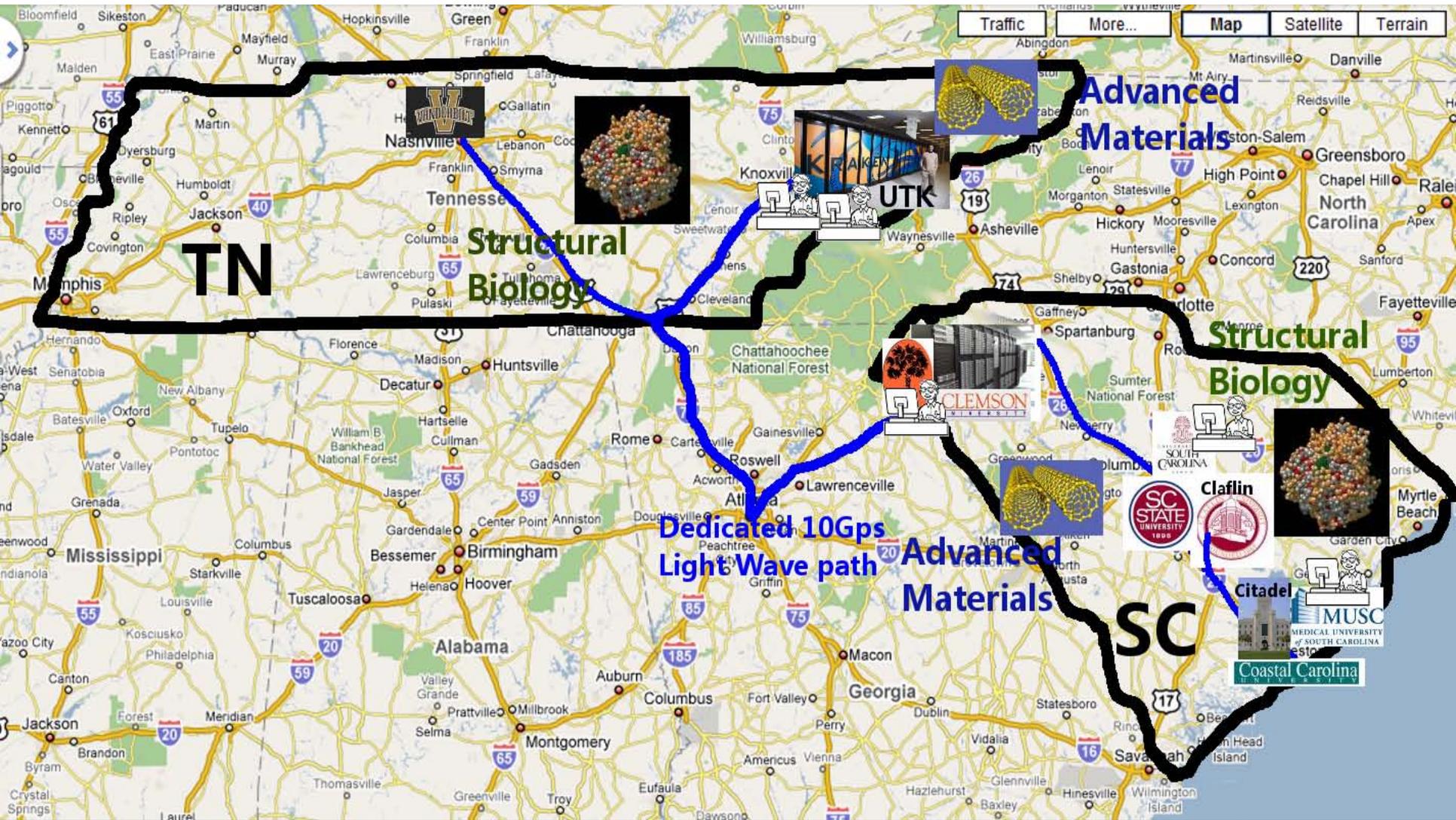
South Carolina: An Evolving Network of Networks

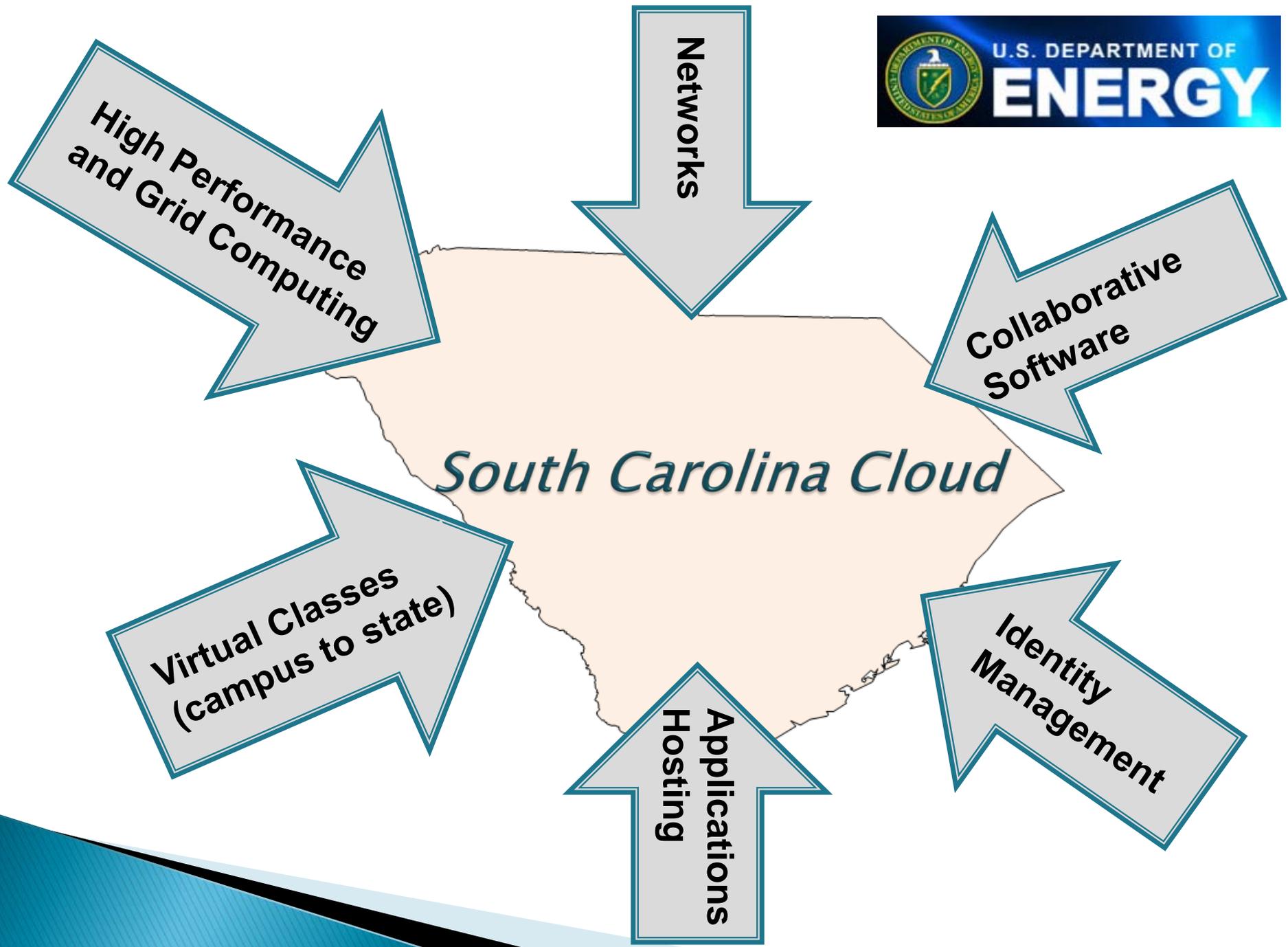


Palmetto State Integrated Fiber Infrastructure (PSIFI)

- \$45 M proposal to Dept. of Commerce/NTIA in response to Broadband Technology Opportunities Program (BTOP)
- Gig connectivity for all public/private SC universities, technical colleges, HBCUs plus healthcare, libraries
- Hundreds of anchor sites
- Facilities based approach vs. current service based
- Leverages costs, exponentially expands capacity, provides flexibility
- Enables/Enhances education delivery, collaborative research, economic development

EPSCoR RII Track 2 Cyberinfrastructure Award – \$6.0 M





Networks

Collaborative Software

South Carolina Cloud

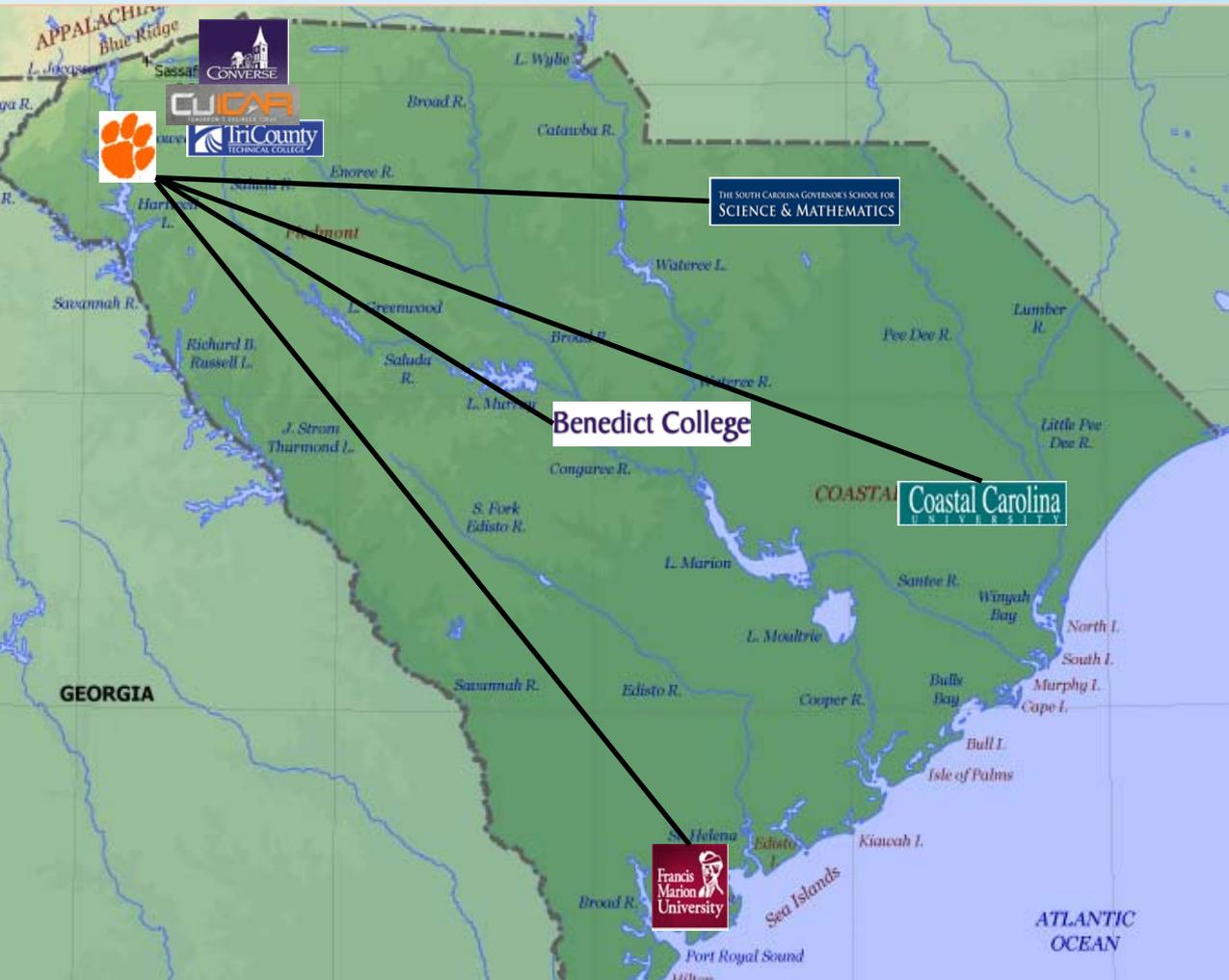
Identity Management

Applications Hosting

**Virtual Classes
(campus to state)**

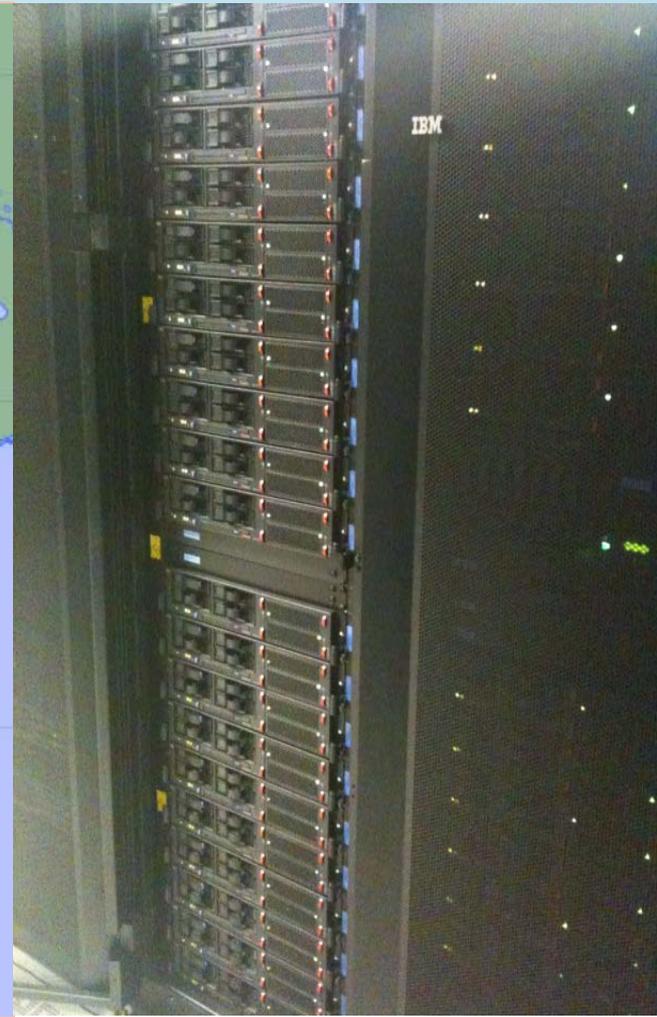
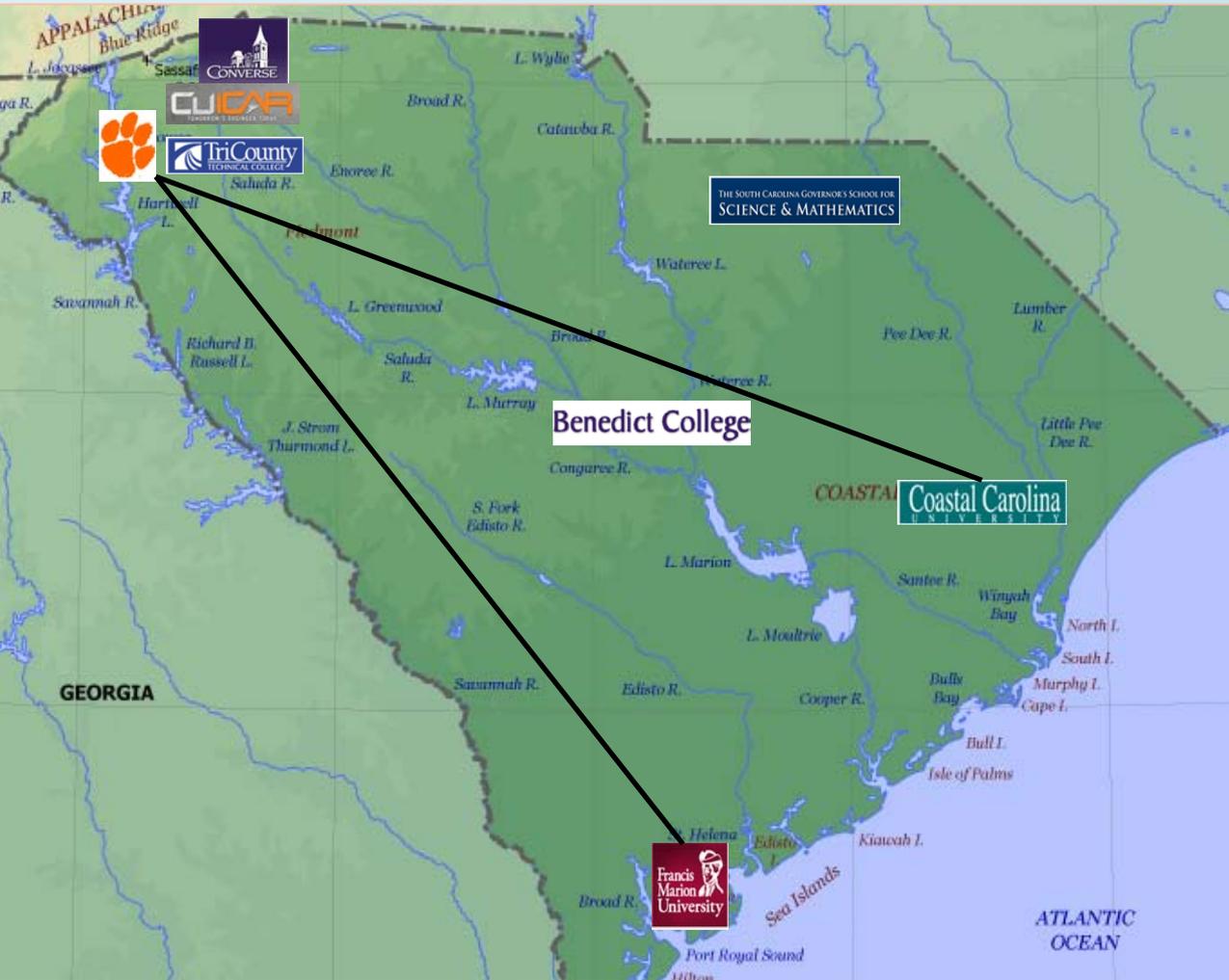
**High Performance
and Grid Computing**

South Carolina Cloud: STEM Teaching – Parallel Computing – Grid Classroom



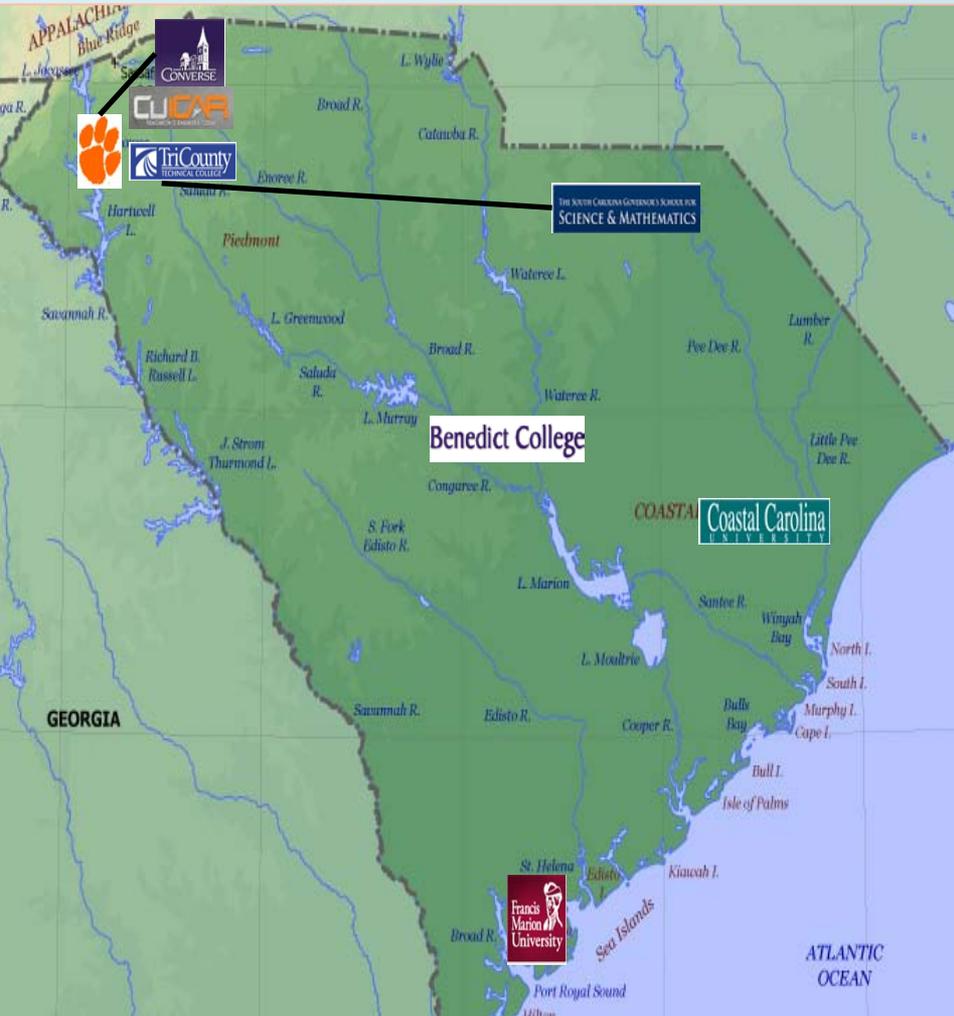
4 universities, 1 high school

South Carolina Cloud: Remote High Performance Computing and System Admin

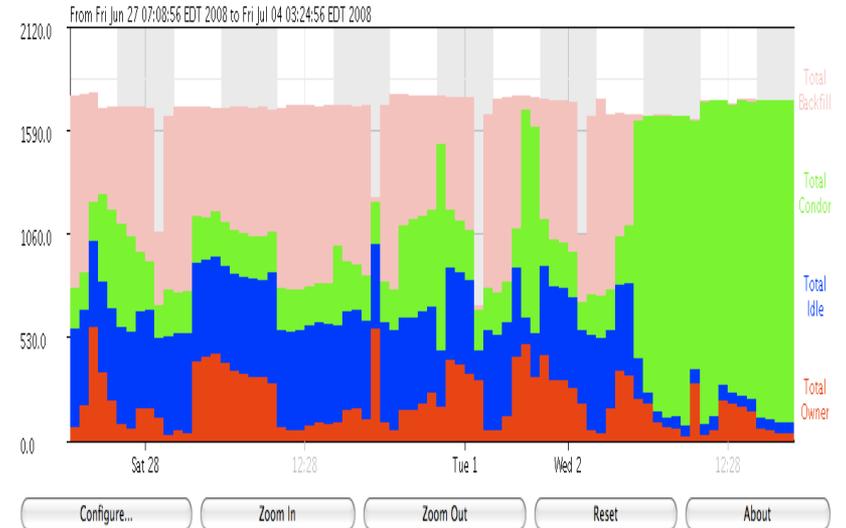


3 universities

South Carolina Cloud: Building Grids



Clemson University Condor Pool Machine Statistics for Week



(Graph Hints: The Y-axis is number of machines, the X-axis is time. When graph finishes updating, press "Configure..." to view different Architecture or State data. Also, you can use the mouse to draw a rectangle on the graph and then press "Zoom In". Press "Reset" to center/resize the data after Configure or when done zooming. Nighttime shows up on graph background as grey.)

Arch	Owner Average	Condor Average	Idle Average	Owner Peak	Condor Peak		
SUN4w/SOLARIS5.10	3.6 (10.4%)	0.0 (0.0%)	31.2 (89.6%)	0.0 (0.0%)	34 (97%)	0 (0%)	
INTEL/LINUX	0.0 (0.2%)	0.0 (0.0%)	4.0 (99.8%)	0.0 (0.0%)	1 (45%)	0 (0%)	
INTEL/WINNTS1	192.1 (12.5%)	573.7 (35.2%)	332.3 (20.4%)	529.9 (31.9%)	602 (62%)	1649 (98%)	
Total	196.5 (12.4%)	577.3 (34.4%)	371.7 (22.2%)	531.9 (31.1%)	637 (59%)	1653 (95%)	

2 universities, 1 high school

South Carolina Cloud: Faculty Activity - FASbook



[Data Entry](#) | [Percent Effort](#) | [Report](#) | [FAS News](#) | [About this page...](#)

Reporting period: Year 2009-2010

Distribution of Effort for Year 2009-2010

	Anticipated Effort				Actual Effort			
	Sum 1	Sum 2	Fall	Spring	Sum 1	Sum 2	Fall	Spring
Coursework	<input type="text"/>							
Other Instructional Activities	<input type="text"/>							
Administrative Duties and Elected Offices	<input type="text"/>							
University Sponsored Public Service	<input type="text"/>							
Librarianship	<input type="text"/>							
Research and Scholarship	<input type="text"/>							
Student Advising/Honors and Graduate Committees	<input type="text"/>							
Committees	<input type="text"/>							
Professional Service and Professional Development	<input type="text"/>							
Personal Community Service and Personal Development	<input type="text"/>							
Total	0							

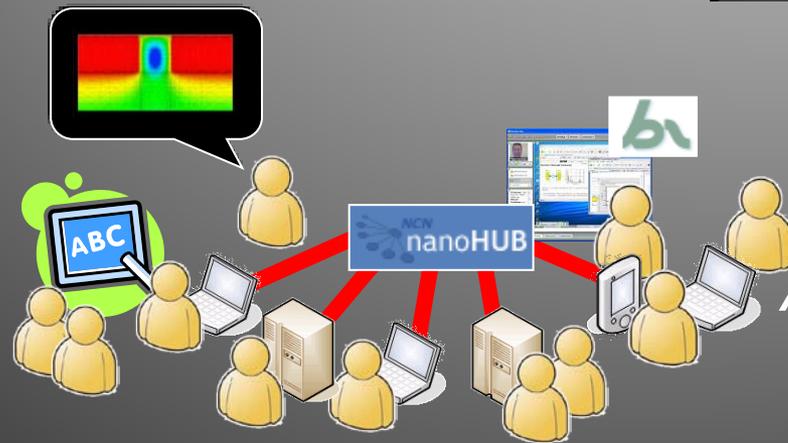
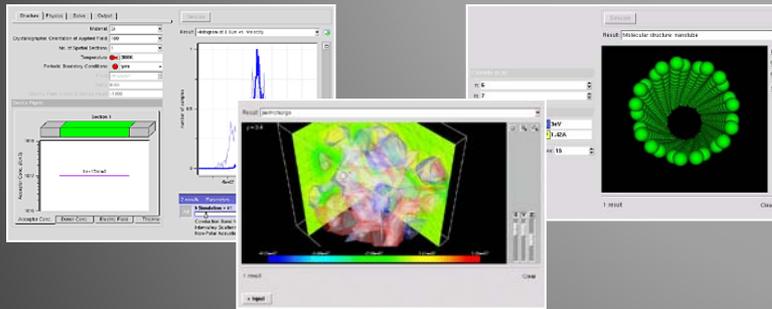
3 universities

...empowering and
supporting a
community.....and
keeping it going....

....two decades of evolution

nanoHUB.org
created and hosted by
the Network for Computational Nanotechnology (NCN)

Online simulation... ..and more!

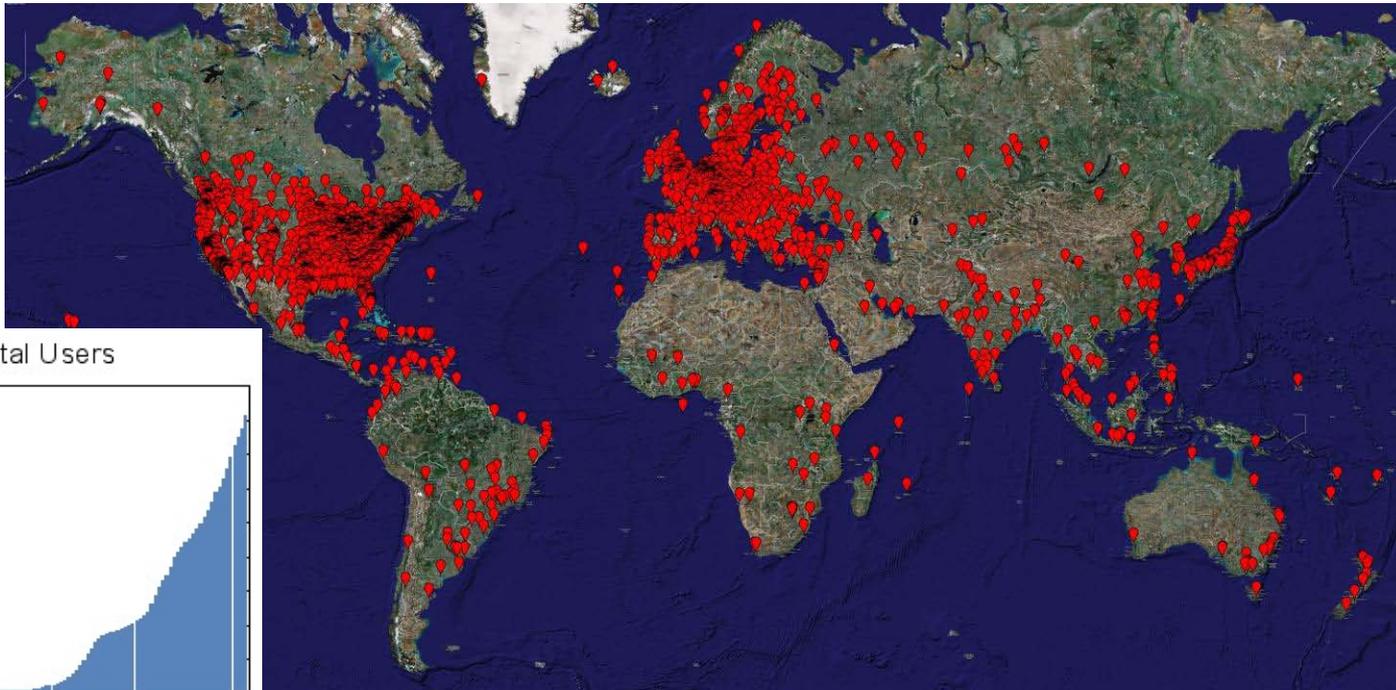


*nanoHUB:
A vibrant community*

*NCN - A Research and Infrastructure Network
Aiming To Move Nanoscience towards Nanotechnology*

Worldwide Community

- >72 million hits last 12 months
- >91,000 unique users last 12 months in 172 countries
- >7,000 simulation users with >400,000 simulations
- >430 citations in research
- >72 classes at >41 institutions in 08/09, >290 classes total
- Users at all U.S. Top 50 Engineering Schools
- 17% of all .edu institutions in the U.S.



HUBzero – a sustainability model for CI.....



Return on Investment

South Carolina



South Carolina Cloud

TERAGRID



CI - TEAM



EPSCoR RII2
*Desktop to TeraGrid
EcoSystem*



SC LightRail



Endowed Chair
in Cyberinfrastructure
- Cyberinstitute

Crossing over organizational silos

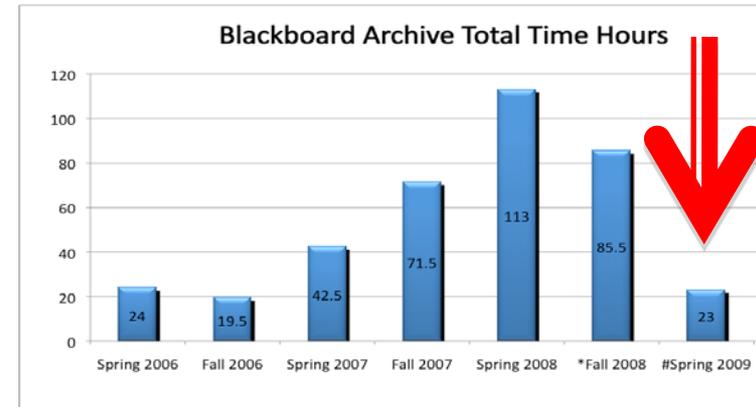
Project Blackbird: Deploying Condor in a Blackboard Environment



Reference: <http://www.educause.edu/eq/>

Innovation for Efficiency

- Reduced total archive time from > 85 hrs to < 24 hrs
- Job scheduling – all servers finish at the same time
- Zero impact to Blackboard Performance
- Load balancing – archive jobs are distributed as cores become available
- Takes advantage of all available CPU cores instead of just one core per server



Commercial potential

End CI Deployment

Questions

- ▶ Issues coordinating programs and investments
 - Federal, state/jurisdiction, institution level
 - ▶ Regulatory issues in optical network expansion?
 - NetNeutrality
 - ▶ NSF role today in campus connections?
- 