

2014 NSF CC-NIE PI Meeting: Collaborative Research Projects

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Arlington, Virginia – May 1, 2014



**NSF Collaborative Research:
CC-NIE Integration:
Developing Applications with Networking
Capabilities via End-to-End SDN (DANCES)**

Kathy Benninger

NSF CC-NIE PI meeting 1 May 2014

Project motivation and development

- Bulk data transfer is a key network-dependent application for supporting HPC
- Backbone is now 100GE, but network congestion frequently exists at campuses/end-sites where links are commonly 10GE
- Network bandwidth scheduling for targeted project flows
- Support for cross-domain SDN signaling
- Integrate SDN into scientific computation infrastructure applications
- Identified researchers and science applications

Collaborators

- XSEDE Service Providers
 - Pittsburgh Supercomputing Center
 - National Institute for Computational Sciences
 - Texas Advanced Computing Center
 - National Center for Supercomputing Applications
- Science projects
 - Penn State Galaxy platform for biomedical research
 - Georgia Tech turbulent fluid flow research
- Internet2

In developing our collaboration...

- Identified specific service/capabilities that were desired. Informed by:
 - User requests for support of priority flows
 - Observed network contention
 - Goal to optimize utilization of resources
- Looked at our current partnerships
 - Networking community
 - Systems software teams
 - User consultants
- Calls, email lists, web site

Henry Neeman

University of Oklahoma

Award #ACI-1341028

**CC-NIE INTEGRATION: ONEOKLAHOMA
FRICTION FREE NETWORK**



The OneOklahoma Cyberinfrastructure Initiative



Henry Neeman
 Asst VP IT –
 Research Strategy Advisor
 Director, OSCER
 Assoc Prof, Engineering
 Adjunct Faculty, CS
 University of Oklahoma
 NSF CC-NIE PI Mtg, Thu May 1



Oklahoma Cyberinfrastructure Initiative

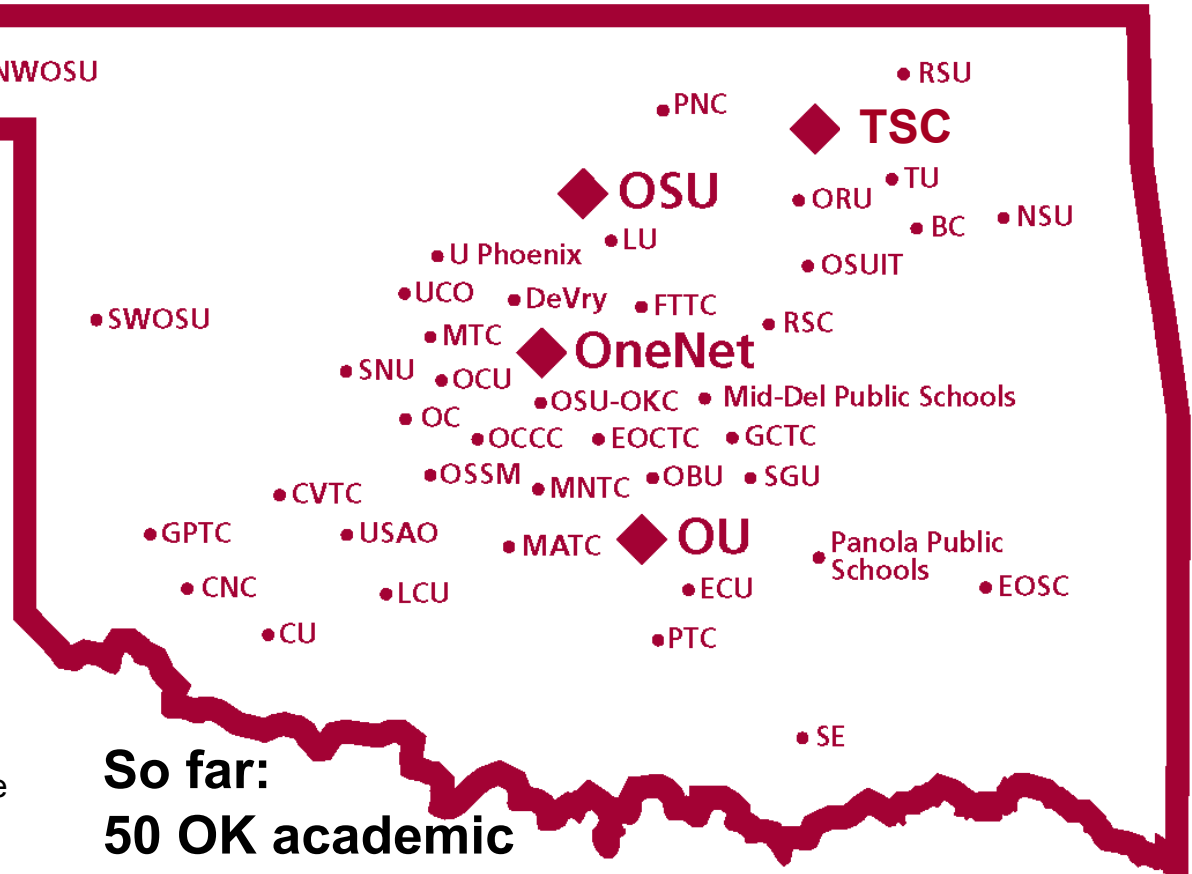
• OPSU

• NWOSU

2008-13

Resource Providers: OU, OSU

- Access to CI (25 OK academic institutions)
- Dissemination: Symposium (25 OK academic)
- Education: “Supercomputing in Plain English” (14 OK academic)
- Fac/Staff Development: summer workshops (18 OK academic)
- Outreach: SiPE overview (24 OK academic)
- Proposal Support: commitment letters, collaborations (4 OK academic)
- Technology: acquired or helped acquire CI (14 OK academic)
- Workforce Development: OK IT Mentorship Program (36 OK academic)



So far:
50 OK academic
47 OK non-academic

OneOklahoma Cyberinfrastructure Initiative

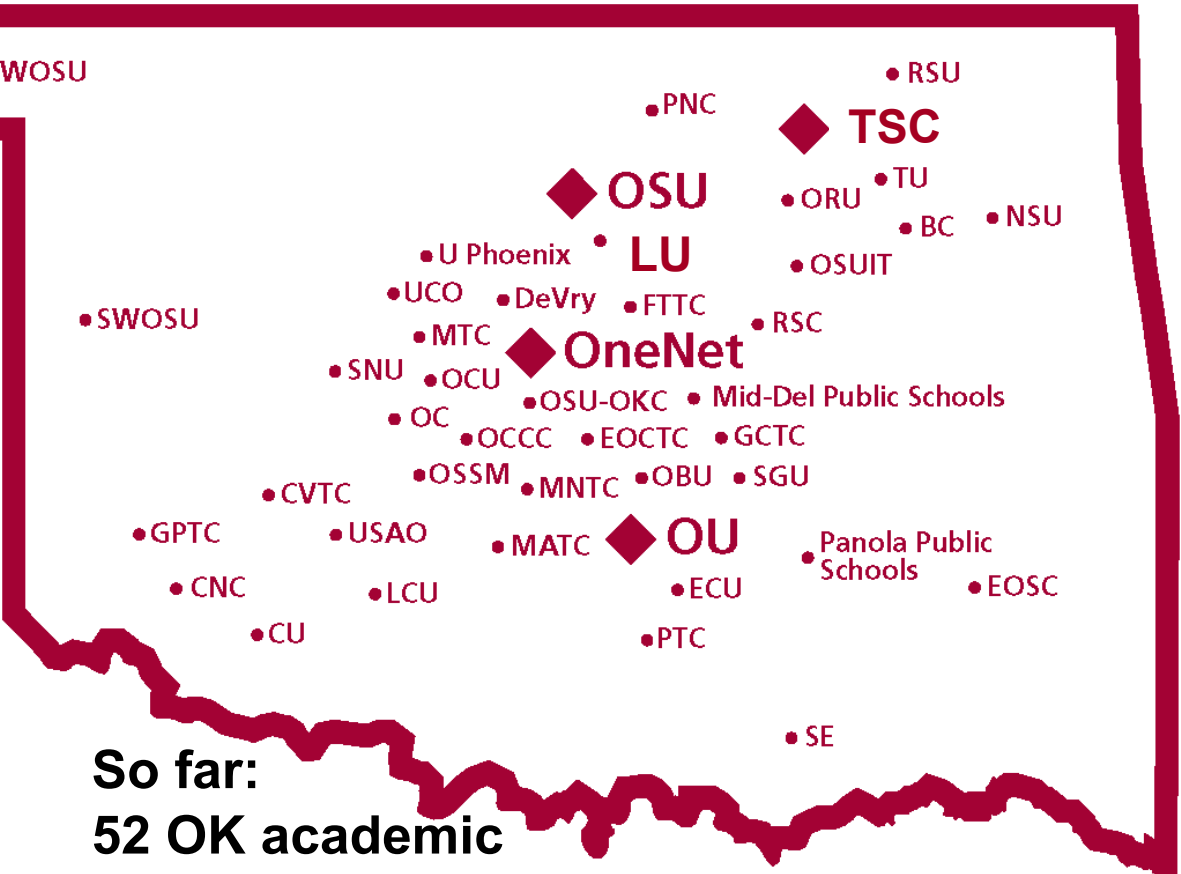
• OPSU

• NWOSU

2013-18

Resource Providers: OU, OSU, TSC, Langston (HBCU, HEP)

- All OCII Services
- Informatics: Research facilitators (NOT researchers) who embed in specific research teams . Expands Informatics team from just OU to OSU, available to others statewide.
- cyberCommons: adaptable Big Data environment developed under OK-KS Track-2 (2009-13).
- Data Stewardship Initiative: collaboration among CI and Libraries.
- OK STEM Mentorship Program: extended OK IT Mentorship Program to other STEM disciplines.



So far:
52 OK academic
48 OK non-academic

Charlie McMahon

Tulane University

Award #ACI-1340454

**CC-NIE NETWORKING
INFRASTRUCTURE: DEDICATED HIGH-
SPEED SCIENCE NETWORK**

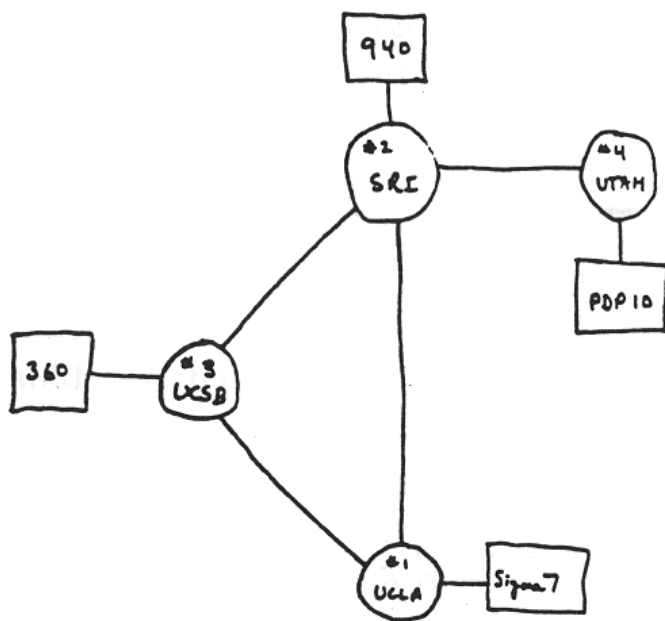
Steve Corbató

University of Utah

Award #ACI-1341034

CC-NIE INTEGRATION: *SCIENCE SLICES*
**CONVERTING NETWORK RESEARCH INNOVATION INTO
ENHANCED CAPABILITY FOR COMPUTATIONAL SCIENCE
AND ENGINEERING AT THE UNIVERSITY OF UTAH**

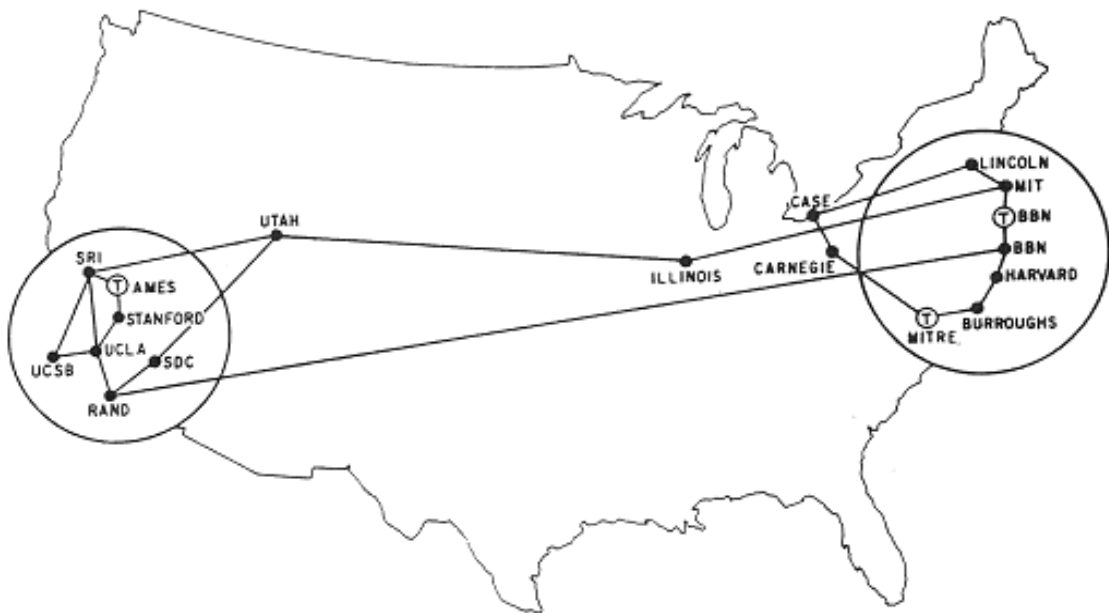
University of Utah CS: the fourth node on the ARPANET – 1969



THE ARPA NETWORK
 DEC 1969
 4 NODES

FIGURE 6.2 Drawing of 4 Node Network
 (Courtesy of Alex McKenzie)

ARPANET (1969-1980)
 Univ. of Utah Computer Science Department
 (now School of Computing)



MAP 4 September 1971

Network research facilitation leverages highly collaborative environment

- **SoC Flux research group (Ricci, Eide, Van der Merwe)**
- University IT
 - CIO Office (VPIT Denna, Corbató)
 - Center for High Performance Computing (Corbató, Breen)
 - Common Infrastructure Services (Ekstrom)
 - Information Security (CISO Bowden)
- VP for Research (VPR Parks, Furse)
- Utah Education Network (Stewart, Quire)
- Utah EPSCoR
- Internet2 (Vietzke, Wolff)

Research infrastructure development

- New University Downtown Data Center
- BONFIRE: Utah's R&E Optical Network
 - NSF EPSCoR RII Cyber Connectivity
 - NTIA BTOP (UEN)
- Network research/computational science
 - NSF MRI Instrument Development: APT (Ricci)
- Campus Network Upgrade and Science DMZ
 - 40-Gbps production backbone upgrade for now
 - NSF CC-NIE Science Slices (this project)

Science Slices

– Focus areas

- Pharmaceutical modeling (Cheatham)
- Astrophysics data mgmt – SDSS-IV (Bolton)
- Genomics (Cairns & Gregg)
- Network/systems research (Ricci & Van der Merwe)
- **Innovative students in Honors College (Torti)**

– Premise (Rob Ricci)

- “What if we turned the concept upside down and built our Science DMZ on top of SDN infrastructure?”

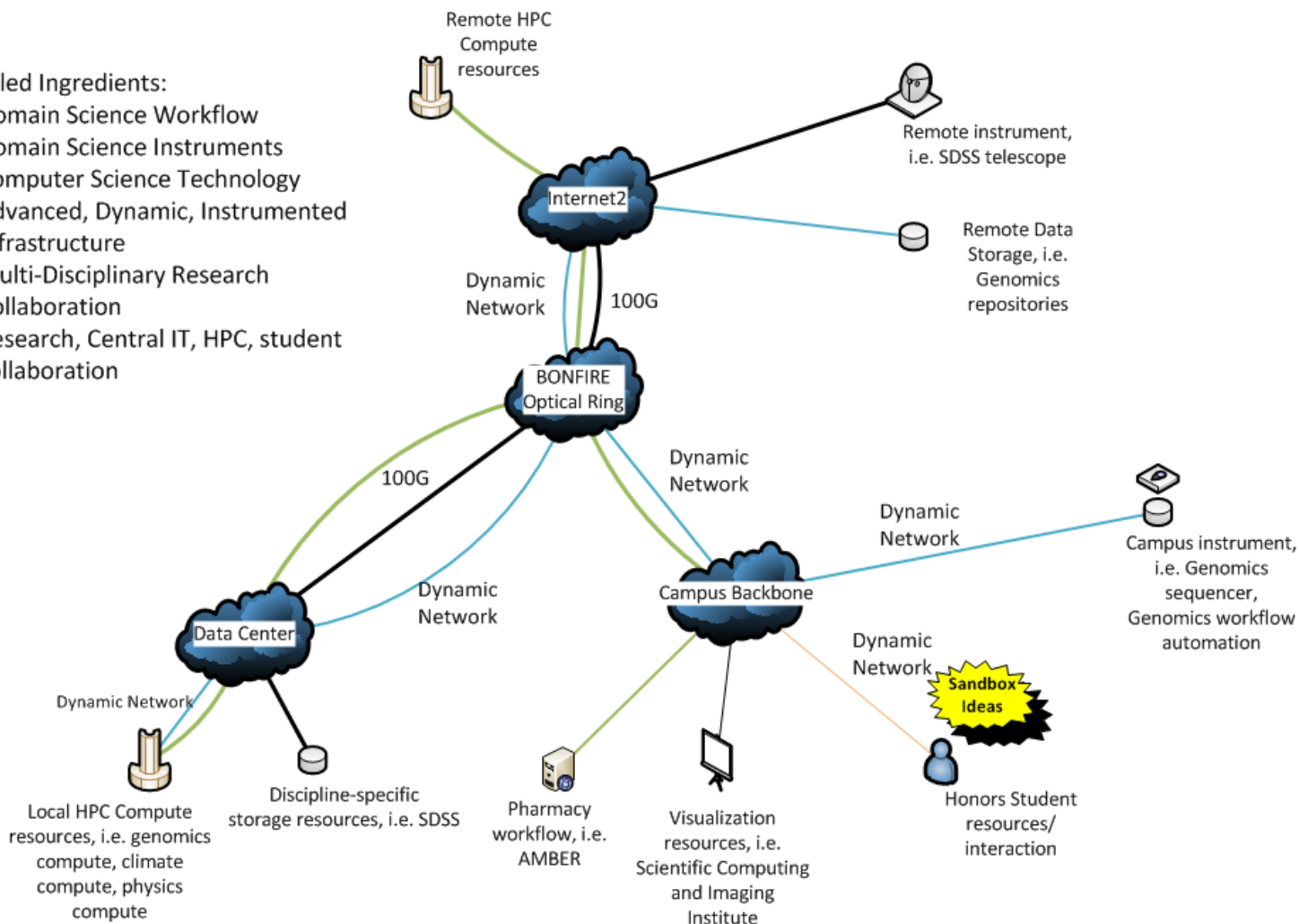
1) Building dynamic Science DMZ on top of Emulab/ protoGENI SDN framework

Detailed Ingredients:

- Domain Science Workflow
- Domain Science Instruments
- Computer Science Technology
- Advanced, Dynamic, Instrumented Infrastructure
- Multi-Disciplinary Research Collaboration
- Research, Central IT, HPC, student collaboration

2) Extending slices to key campus labs, HPC center, and Honors residence

3) Doing this in concert with central IT



Q&A and general discussion

- What's the best mechanism you've discovered for fostering the collaboration that you've described?
- What are the greatest remaining obstacles to CI/researcher collaboration?
- What are the most effective techniques for attracting researchers in non-traditional disciplines?
- What are realistic objectives for the next CC*IIE solicitation to drive the next level of CI/research collaboration?