

Campus Cyberinfrastructure – Network Infrastructure and Engineering (CC-NIE)

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(Post NSFnet) Brief History of NSF Investments in Network Infrastructure

- ❖ vBNS and High Performance Connections Program (HPNC) – 1995-2003
 - National backbone and connections
- ❖ International Networking (IRNC) – 1997 – present
 - Connecting US to the world
- ❖ Experimental Infrastructure Networking (EIN) - 2003
- ❖ “Academic Research Infrastructure Program – Recovery and Reinvestment” - 2009
 - Subset: Optical exchange, regional networking upgrades
- ❖ EPScOR – Research Infrastructure Improvement (RII) – 2011
 - Inter-campus, intra-campus connectivity
- ❖ STCI program (2011 – “100G Connectivity for Data-Intensive Computing at JHU”, Lead PI: Alex Szalay)



ACCI Task Force on Campus Bridging

- ❖ *Strategic Recommendation to the NSF #3: The National Science Foundation should create a new program funding high-speed (currently 10 Gbps) connections from campuses to the nearest landing point for a national network backbone. The design of these connections must include support for dynamic network provisioning services and must be engineered to support rapid movement of large scientific data sets."* - pg. 6, National Science Foundation Advisory Committee for Cyberinfrastructure Task Force on Campus Bridging, Final Report, March 2011
- ❖ www.nsf.gov/od/oci/taskforces/TaskForceReport_CampusBridging.pdf
- ❖ Also see Campus Bridging Technologies Workshop: Data and Networking Issues Workshop Report. G.T. Almes, D. Jent and C.A. Stewart, eds., 2011, <http://hdl.handle.net/2022/13200>



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- ❖ NSF 12-541 – solicitation released March 1, 2012
- ❖ http://www.nsf.gov/publications/pub_summ.jsp?WT.z_pims_id=504748&ods_key=nsf12541
- ❖ 1st area: Data Driven Networking Infrastructure for the Campus and Researcher
- ❖ 2nd area: Network Integration and Applied Innovation
- ❖ This was a networking solicitation
- ❖ Proposals were due May 30, 2012



CC-NIE

- ❖ **Original Estimate of Number of Awards:** 10 to 20
- ❖ **Originally Anticipated Funding Amount:**
 - \$12,000,000 to \$15,000,000 would be available for this competition in FY 2012.
 - Data Driven Networking Infrastructure for the Campus and Researcher awards would be supported at up to \$500,000 total for up to 2 years.
 - Network Integration and Applied Innovation awards would be supported at up to \$1,000,000 total for up to 2 years.
- ❖ Proposals may only be submitted by Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.



CC-NIE Area#1 - Data Driven Networking Infrastructure for the Campus and Researcher

- ❖ network infrastructure improvements at the campus level
- ❖ network improvements include:
 - network upgrades within a campus network to support a wide range of science data flows
 - re-architecting a campus network to support large science data flows, for example by designing and building a "science DMZ" (see <http://fasterdata.es.net/science-dmz/> for more information on the "science DMZ" approach)
 - campus network upgrades addressing sustainable infrastructure through improvements in energy efficient networking.
 - campus network upgrades addressing the growing needs in mobile networking.
 - Network connection upgrade for the campus connection to a regional optical exchange or point-of-presence that connects to Internet2 or National Lambda Rail.



CC-NIE Area#2 – Network Integration and Applied Innovation

- ❖ end-to-end network CI through integration of existing and new technologies and applied innovation
- ❖ Applying network research results, prototypes, and emerging innovations to enable (identified) research and education
- ❖ May leverage new and existing investments in network infrastructure, services, and tools by combining or extending capabilities to work as part of the CI environment used by scientific applications and users



GENI Community Key Additional Criteria Area 1

Data movement scenarios are encouraged to describe end-to-end data transfers that include access to and use of wide area dynamic circuit networking services.

Should describe an approach to end-to-end network performance measurement based on the perfSonar framework with associated tool installation and use; proposals may describe an alternative approach to perfSonar with sufficient justification.



GENI Community Key Additional Criteria Area 2

Transitioning successful research prototypes in SDN, and activities supported by GENI and FIA programs, to distributed scientific environments and campus infrastructure

Area 2 Relevant Activity: Experimental deployment of new networking protocols and technologies



CC-NIE 2012 Stats

- ❖ Proposals were due May 30
- ❖ 89 proposals received (\$52M+ requested)
- ❖ 39 awards made (34 projects total)
- ❖ 34 different institutions
- ❖ 23 states
- ❖ Total funding: \$21.6M (that includes \$3M in co-funding from CISE/CNS)
 - Area#1: \$9.7M, 21 awards
 - Area#2: \$11.9M, 18 awards



Criteria for CISE Co-funding

- Supports on-going GENI engagements by connecting GENI related infrastructure to Internet2 or other dynamically switched backbones, or otherwise extends existing GENI related infrastructure
- Explicit discussion of GENI, OpenFlow and the use of the infrastructure by the Computer Science Faculty at the University
- Describes experimentation based on GENI to be enabled by the infrastructure
- Develops tools or protocol implementations that directly benefit the GENI effort
- Deployment of dynamic circuits deep into campus with benefits to the CS department



Award List (unordered)

Institution	PI	Title
Colorado State U	Burns, Patrick	CC-NIE Data-Driven Network Infrastructure Upgrade for Colorado State University
Univ of Washington	Lazowska, Edward	CC-NIE Network Infrastructure: Enhancements to Support Data-Driven Discovery at the University of Washington
Virginia Tech	Gardner, Mark	CC-NIE Network Infrastructure: ASCED -- An Advanced Scientific Collaboration Environment and DMZ
U of Chicago	Jelinkova, Klara	CC-NIE Network Infrastructure: High Performance Research Networking (HiPerNet)
Penn State	Agarwala, Vijay	CC-NIE Network Infrastructure: Accelerating the Build-out of a Dedicated Network for Education and Research in Big Data Science and Engineering
Duke	Futhey, Tracy	CC-NIE Network Infrastructure: Using Software-Defined Networking to Facilitate Data Transfer
U of Florida	Deumens, Erik	CC-NIE Network Infrastructure: 100Gig Connection to FLR
U of Wisconsin	Maas, Bruce	CC-NIE Network Infrastructure: Advancing Network Capacity, Efficiency, and Security for Wisconsin Big Data Research Through Improvement of campus research DMZ
U of Oregon	Rejaie, Reza	CC-NIE Network Infrastructure: Bridging Open Networks for Scientific Applications and Innovation (BONSAI)
Florida International U	Ibarra, Julio	CC-NIE Network Infrastructure: FlowSurge: Supporting Science Data Flows towards discovery, innovation and education



Award List

Institution	PI	Title
UT Knoxville	Hazelwood, Victor G.	CC-NIE Network Infrastructure: Bandwidth for Leadership in Advancing Science and Technology (BLAST)
UC San Diego	Papadopoulos, Philip	CC-NIE Network Infrastructure: PRISM@UCSD: A Researcher Defined 10 and 40Gbit/s Campus Scale Data Carrier
San Diego State	Castillo, Jose	CC-NIE Network Infrastructure: Implementation of a Science DMZ at San Diego State University to Facilitate High-Performance Data Transfer for Scientific Applications
U of North Carolina	Aikat, Jay	CC-NIE Network Infrastructure: Enabling data-driven research
Florida State U	Barret, Michael	CC-NIE Network Infrastructure: NoleNet Express Lane -- a private network path for research data transmission at Florida State University and beyond
U of Michigan	Noble, Brian	CC-NIE Network Infrastructure: Expanding Connectivity to Campus-Wide Resources for Computational Discovery
Wayne State	Cinabro, David	CC-NIE Network Infrastructure: Wayne State University
Yale	Sherman, Andrew	CC-NIE Network Infrastructure: The Future of Research & Collaboration: The Dedicated Science Network
Louisiana State U	Tohline, Joel	CC-NIE Network Infrastructure: CADIS -- Cyberinfrastructure Advancing Data-Interactive Sciences
U of Colorado	Hauser, Thomas	CC-NIE Network Infrastructure: Improving an existing science DMZ
Texas A&M	Cantrell, Pierce	CC-NIE Network Infrastructure: Advanced Connectivity for Texas A&M University



Award List

Institution	PI	Title
Indiana U	Swany, Douglas	Collaborative Research: CC-NIE Integration: An Open Cloud Infrastructure for Scalable Data Intensive Collaboration
UT Knoxville	Beck, Micah	Collaborative Research: CC-NIE Integration: An Open Cloud Infrastructure for Scalable Data Intensive Collaboration
Vanderbilt	Sheldon, Paul	Collaborative Research: CC-NIE Integration: An Open Cloud Infrastructure for Scalable Data Intensive Collaboration
U of Chicago	Tuecke, Steven	Collaborative Research: CC-NIE Integration: A Data Movement Solution for Next-Generation Campus Cyberinfrastructure
Indiana U	Swany, Douglas	Collaborative Research: CC-NIE Integration: A Data Movement Solution for Next-Generation Campus Cyberinfrastructure
U of Maryland	Voss, Brian	CC-NIE Integration: SDNX - Enabling End-to-End Dynamic Science DMZ
Ohio State	Whitacre, Caroline	CC-NIE Integration: Innovations to Transition a Campus Core Cyberinfrastructure to Serve Diverse and Emerging Researcher Needs
UMass Amherst	Dubach, John	CC-NIE Integration: Multi-Wave - a Dedicated Data Transport Ring to Support 21st Century Computational Research
Clemson	Wang, Kuang-Ching	CC-NIE Integration: Clemson-NextNet
U of Kentucky	Kellen, Vincent	CC-NIE Integration: Advancing Science through Next Generation SDN Networks



Award List

Institution	PI	Title
Stanford	McKeown, Nick	CC-NIE Integration: Bringing SDN based Private Cloud to University Research
U of North Carolina	Baldine, Ilia	Collaborative Research: CC-NIE Integration: Transforming Computational Science with ADAMANT (Adaptive Data-Aware Multi-domain Application Network Topologies)
U of Southern California	Deelman, Eva	Collaborative Research: CC-NIE Integration: Transforming Computational Science with ADAMANT (Adaptive Data-Aware Multi-domain Application Network Topologies)
Duke	Chase, Jeffrey	Collaborative Research: CC-NIE Integration: Transforming Computational Science with ADAMANT (Adaptive Data-Aware Multi-domain Application Network Topologies)
U of Nebraska	Bockelman, Brian	CC-NIE Integration: Bringing Distributed High Throughput Computing to the Network with Lark
Caltech	Newman, Harvey	CC-NIE Integration: ANSE (Advanced Network Services for Experiments)
Missouri U - Columbia	Springer, Gordon	CC-NIE Integration: Creation of an Institutional Cyberinfrastructure to Enable Researcher-Oriented, Federated Environment for Large, Collaborative Science Projects
UC Davis	Bishop, Matt	CC-NIE Integration: Improved Infrastructure for Data Movement and Monitoring