An Overview: Directorate for Computer and Information Science and Engineering

at

National Science Foundation

Suzi Iacono, Ph.D.

Senior Science Advisor

siacono@nsf.gov

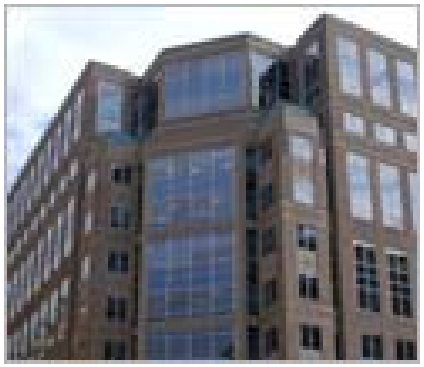
Min Song

msong@odu.edu

Greetings from Washington, DC!

Road Map

- NSF and CISE Overview
- Proposal and Funding Statistics
- Highlights & Community Involvement
- Concluding Remarks



National Science Foundation

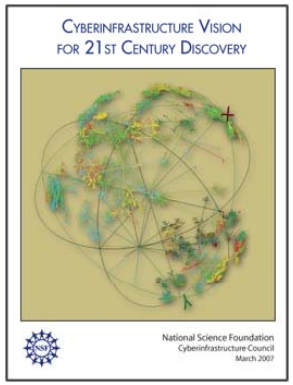
Mission: To promote the progress of science; to advance the national health, prosperity and welfare; and to secure the national defense.

Highly Competitive

Competitive

Not Competitive

NSF's Investment Priorities



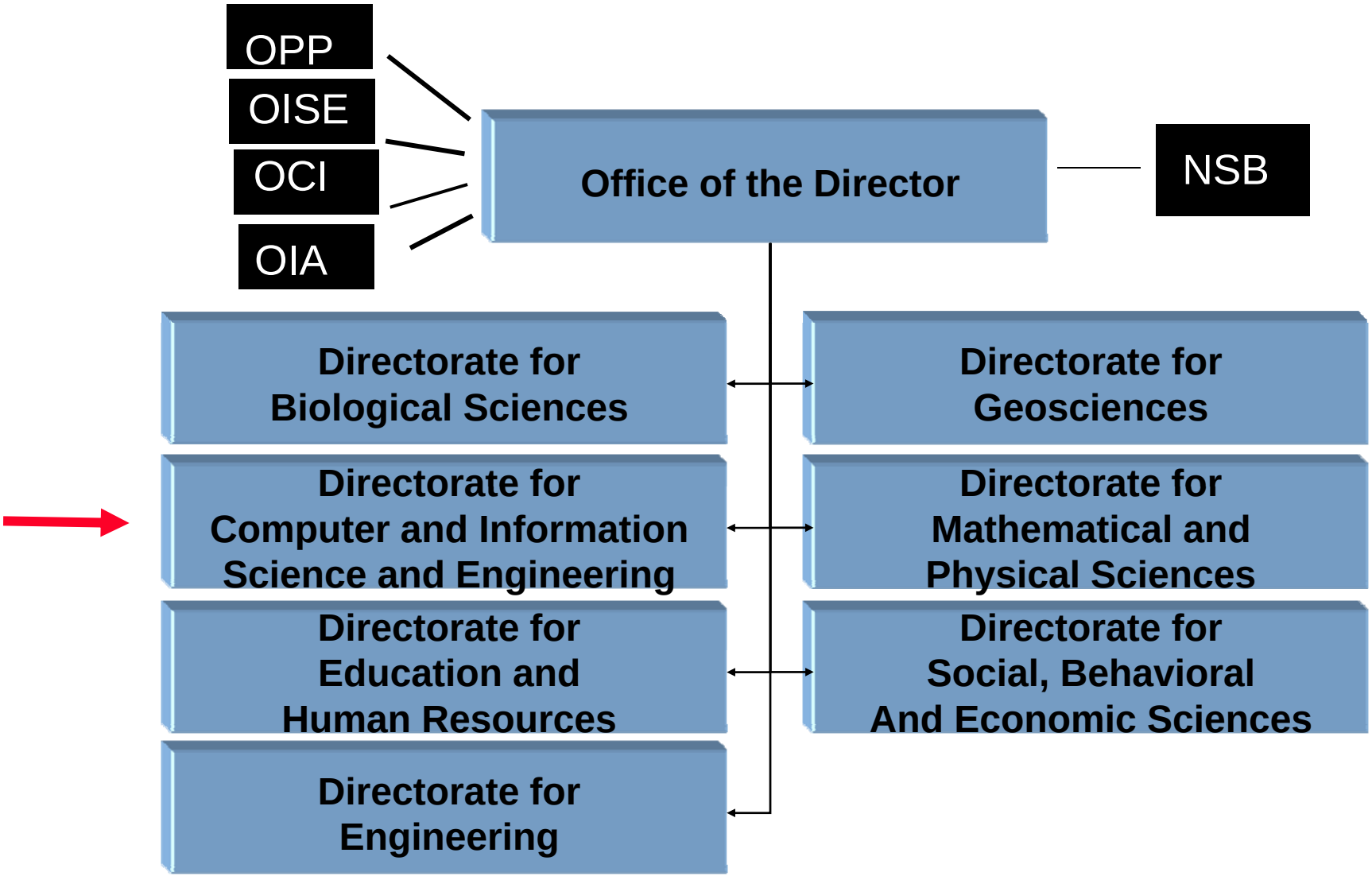
Discovery
Foster research
at the frontiers

Infrastructure
Build Nation's capacity
through tools and CI

Learning
Cultivate a science and
engineering workforce

NSF Stewardship
Supporting the science and engineering research and
education enterprise

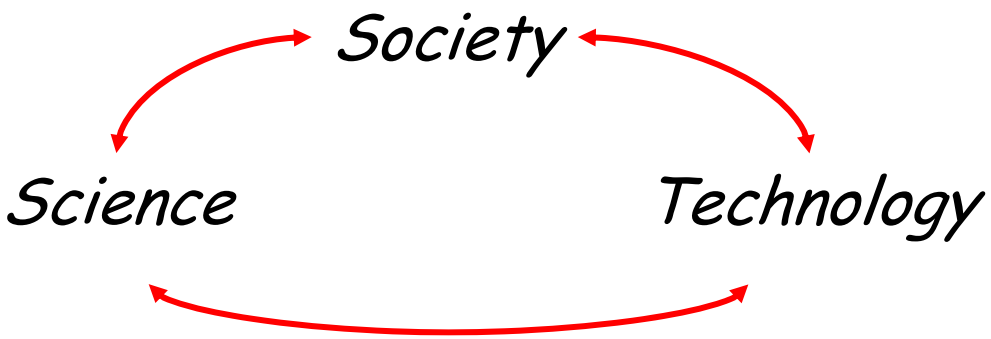
NSF Organization



Computer and Information Science and Engineering Directorate

Overview

Drivers of Computing

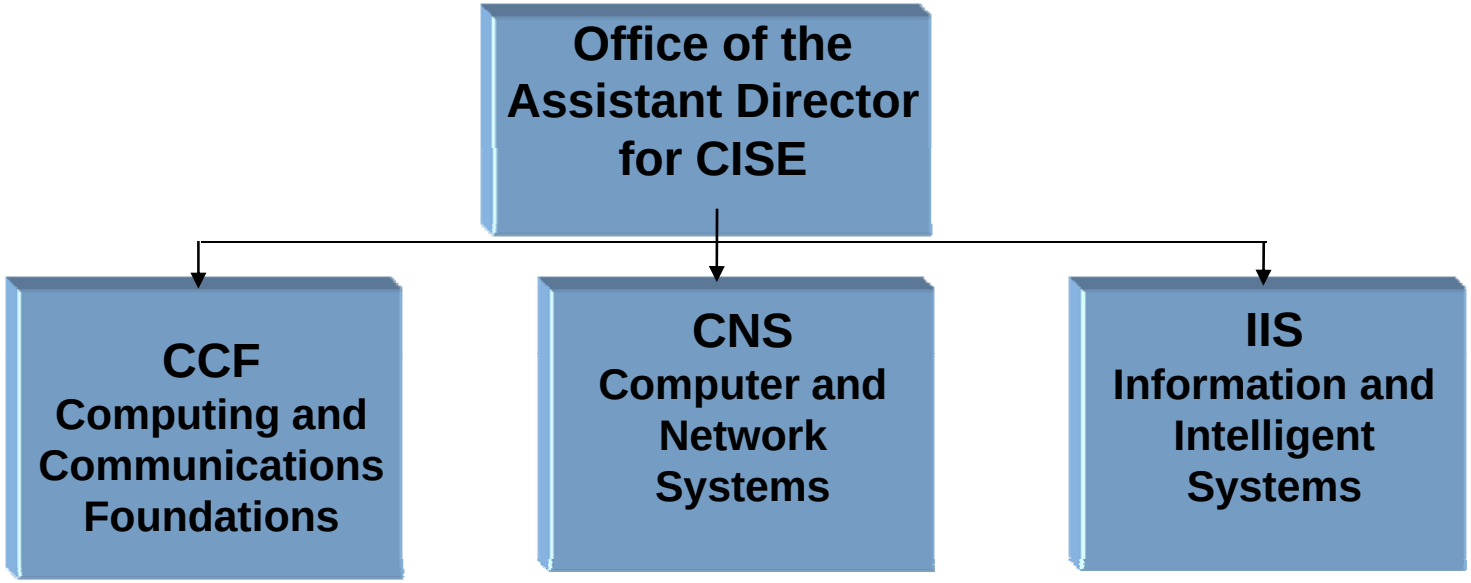


CISE Budget and Budget Outlook

- FY 2011 Request = $684.5M, $65.68M increase over FY 2010
- America Competes Act 2007 authorizes additional NSF funding, setting pace for doubling of the NSF Research and Related Activities account over the next 7 years
  - Reauthorization in 2010 passed the House, but has not been voted on by the Senate
  - Requires post-doc mentoring plans
  - PCAST was formed in 2010 to serve instead of President's Council on Innovation and Competitiveness
- President's Plan for Science and Innovation – commitment to double the budgets of NSF, NIST, and DoE Office of Science
- However, NSF does not have an appropriation bill for 2011

NSF provides 84% of all Federal support for basic research in computer science

CISE Organization Chart and Core Research Programs



CORE PROGRAMS

- Algorithmic Foundations
- Communication and Information Foundations
- Software and Hardware Foundations
- Computer Systems Research
- Networking Technology and Systems
- Education and Workforce
- Human-Centered Computing
- Information Integration and Informatics
- Robust Intelligence

~ 70-75% of CISE Budget in Core Programs

CISE Contributions to NSF's Strategic Goals (1)

- Discovery: Advance the Frontiers of Computing
  - Core CISE programs
  - Programs specialized to serve different groups
    - CAREER (for new faculty) – deadline for all core CISE programs in July
    - Research in Undergraduate Institutions (RUI) (for faculty at undergraduate institutions) - may be submitted to any CISE program
    - Grant Opportunities for Academic Liaison with Industry (GOALI) – (includes industry) may be submitted to any CISE program

CISE Contributions to NSF's Strategic Goals (2)

- Discovery: Advance the Frontiers of Computing
  - Multidisciplinary program solicitations
    - Cyber-Enabled Discovery and Innovation (CDI) – began in FY'08
    - Collaborative Research for Computational Neuroscience (CRCNS)
    - Socially Intelligent Computing (SoCS)
    - CyberPhysical Systems (CPS)
  - Center-like programs (funding of several $M/year/project for 5-10 years)
    - Science and Technology Centers
    - Engineering Research Centers
    - Expeditions in Computing
    - Future Internet Architecture (FIA)

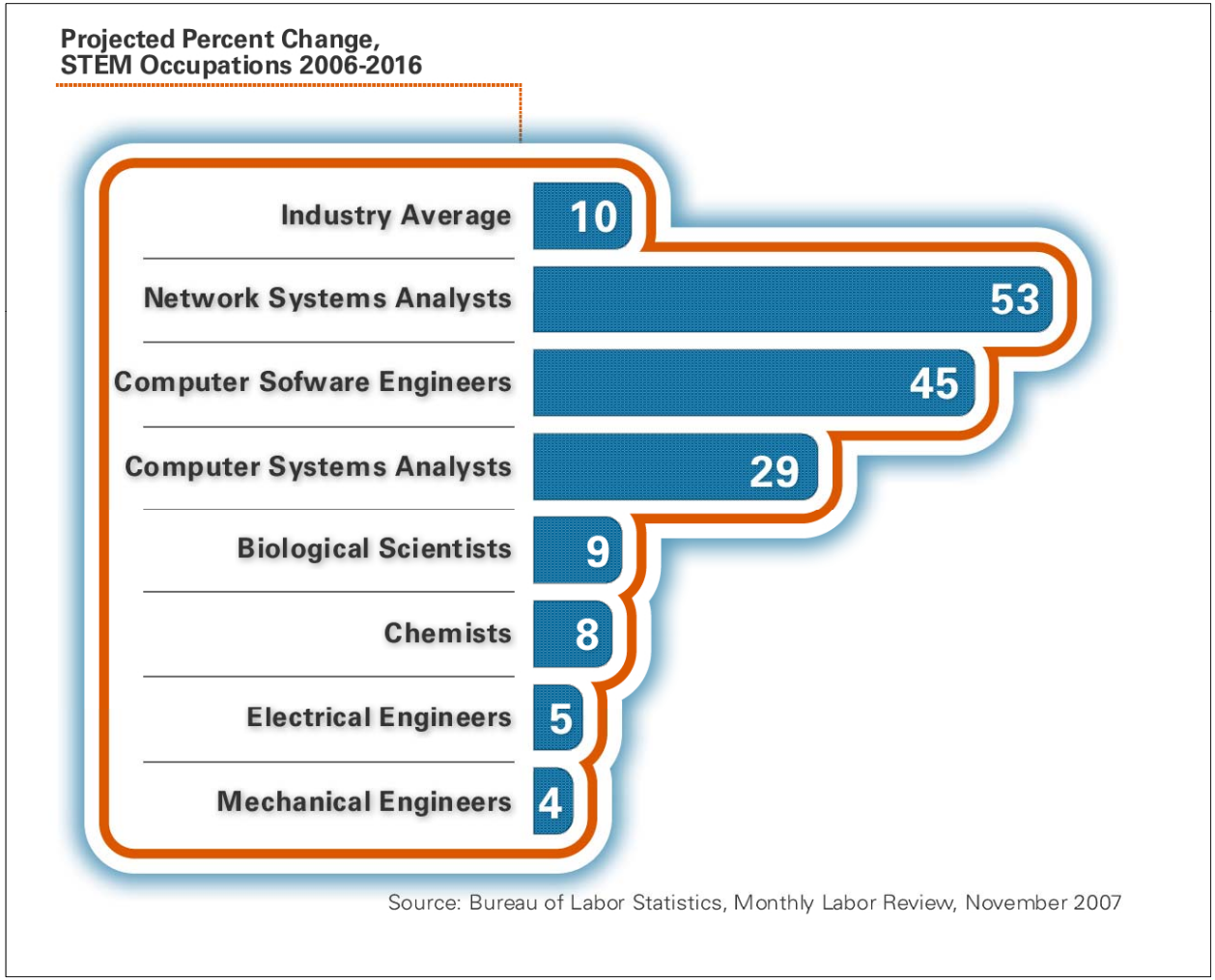
Expeditions in Computing

- Pursue ambitious, fundamental research that promises to define the future of computing
- Investigators collaborate across disciplinary and institutional boundaries
- Catalyze far-reaching research explorations motivated by deep scientific questions
- Inspire current and future generations of Americans, especially those from under-represented groups
- Stimulate significant research and education outcomes that promise scientific, economic and/or other societal benefits
- Ten awards have already been made over three years
- **Preliminary Proposal Due Date *(required):*** September 10, 2010
- **Full Proposal Deadline:** April 10, 2011

CISE Contributions to NSF's Strategic Goals (3)

- Learning: Build a highly competent and diverse computing workforce for the 21st century
  - CISE-specific
    - Computing Education for the 21st Century
  - NSF-wide programs
    - Research Experiences for Undergrads (REU) Sites and Supplements
    - Integrative Graduate Education & Training (IGERT)
    - Graduate Research Fellowships
    - Scholarships for Service
    - NEW: Cyberlearning: Transforming Education

Job growth is in IT



Underproduction

By 2018, there will be 1.4 million computer specialist job openings.

US universities will have generated enough graduates to fill about 1/3 of these openings.

NCWIT, By the Numbers, 2009

CISE Contributions to NSF's Strategic Goals (4)

- Research Infrastructure: Support development and acquisition of research instruments that enable high-quality computing research
  - CISE-specific
    - Computing Research Infrastructure
    - GENI
  - NSF-wide program
    - Major Research Instrumentation (MRI)

Building the GENI Meso-scale Prototype

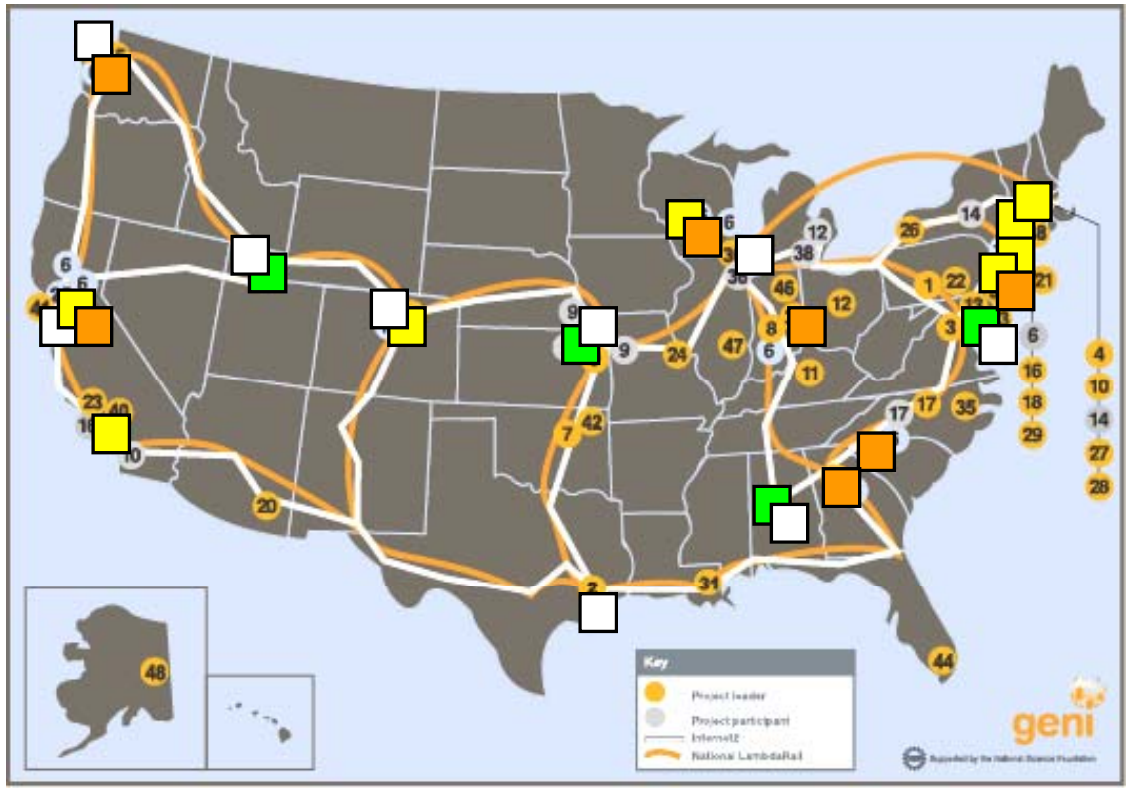
Current plans for locations & equipment

OpenFlow

Stanford
U Washington
Wisconsin
Indiana
Rutgers
Princeton
Clemson
Georgia Tech

ShadowNet

Salt Lake City
Kansas City
DC
Atlanta

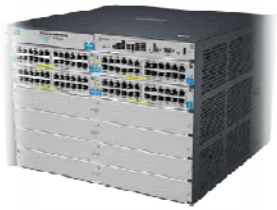


WiMAX

Stanford
UCLA
UC Boulder
Wisconsin
Rutgers
Polytech
UMass
Columbia

OpenFlow Backbones

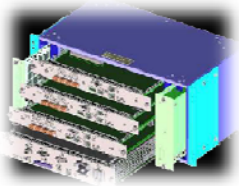
Seattle
Salt Lake City
Sunnyvale
Denver
Kansas City
Houston
Chicago
DC
Atlanta



HP ProCurve 5400 Switch

Juniper MX240 Ethernet Services Router

Arista 7124S Switch

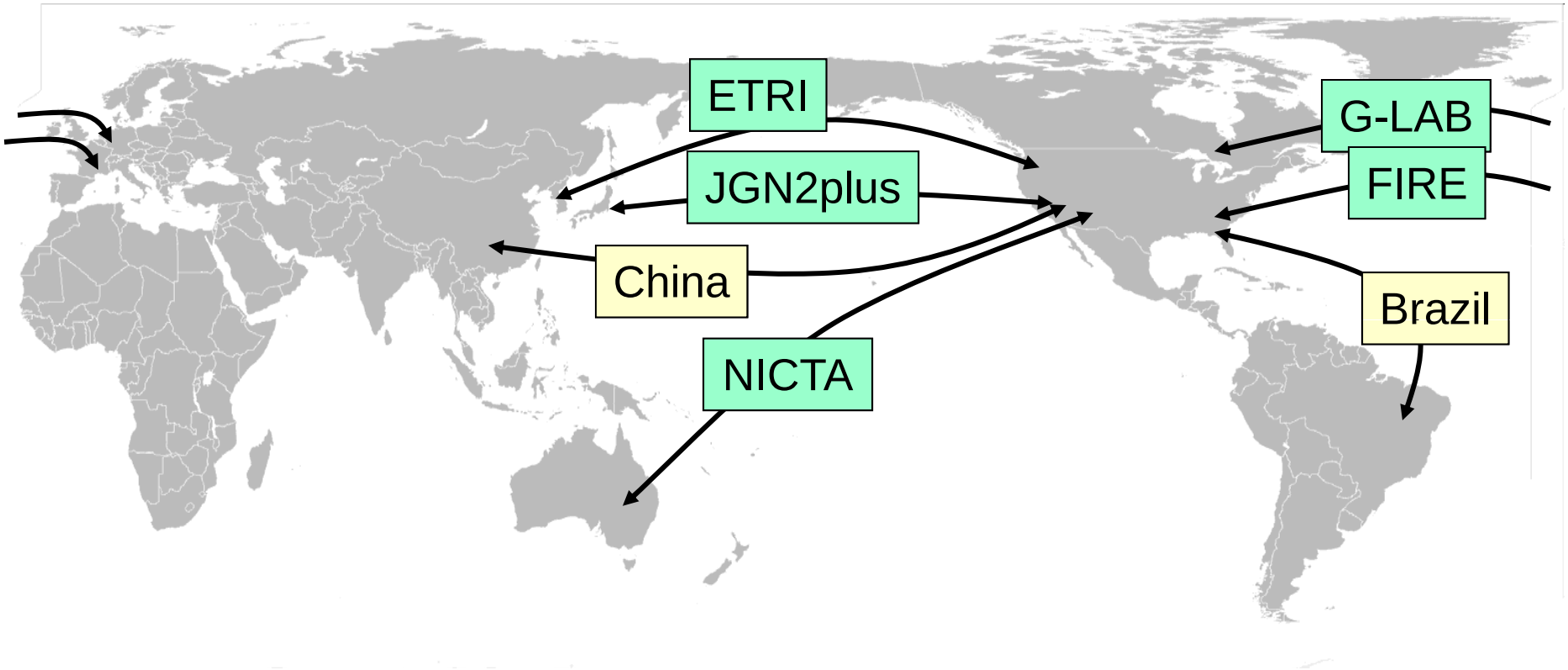


NEC WiMAX Base Station

Cisco 6509 Switch

NEC IP8800 Ethernet Switch

These are exciting times all around the world!



- The GENI project is actively collaborating with peer efforts outside the US, based on equality and arising from direct, “researcher to researcher” collaborations.

CISE Cross-cutting Programs FY2011

- New solicitation that covers cross-cutting areas that benefit from intellectual contributions of researchers with expertise in a number of fields or sub-fields
- Invites small (<$500K), medium (<$1.2M) and large (<$3M) projects
- Eligibility – no more than 2 proposals per senior personnel
- Dates: Large (Nov.1-28); Small (Dec. 1-17)
- Focus areas are:
  - NEW: Smart Health and Well-being
  - Network Science and Engineering (last year)
  - Trustworthy Computing

Smart Health and Well-being

- Focus is on new realities: from acute to chronic health issues; from the hospital and clinic to the home; from sickness to health; to ubiquitous healthcare delivery
- The goal of the Smart Health and Wellbeing program is to seek improvements in safe, effective, efficient, equitable, and patient-centered health and wellness services through innovations in computer and information science and engineering.
- Broad areas include:
  - Personalized medicine and feedback
  - Virtual worlds; mobile health; robotics; natural language processing
  - Interoperable medical devices
  - Continuous monitoring and feedback
  - Privacy and security
  - Usability and understanding mental models of people

The Healthcare Crisis

- The cost of healthcare in the U.S. is the highest in the world (per capita, % GDP)
- The U.S. ranked 37th in the 2000 WHO study of healthcare system performance (8 underlying measures)
- 50% Americans have 1 or more chronic diseases; age of onset getting younger
- 98,000 deaths per year due to medical errors
- 3 lifestyle behaviors (poor diet, lack of exercise, smoking) cause est. 1/3rd of US deaths
- Current individual medical records have an error rate of 20%

The Healthcare Crisis

- Aging: 85+ is the most rapidly increasing age cohort.
- Nearly half of persons over age 85 have Alzheimer's disease
- Disease prevalence with age > 85 years
  - Nursing home 20%
  - Incontinence 30%
  - Depression 10%
  - Parkinson's < 10%
- Comorbidity
  - 80% have ≥ 1 chronic condition
  - 50% have ≥ 2 chronic conditions
  - 25% have ≥ 3 chronic conditions
- For those >65, 30% of hospital admissions are due to medication non-compliance
- By 2030, 1 in 2 working adults will be an informal caregiver
- In 2008 the U.S. graduated only 238 primary care physicians

Example challenge we can meet

Aging independently in place:

Move ¼ of institutional care to the home in 10 years

Computational enablers

- Medication reminders
- Exercise / therapy coaches
- Medical instrument preparation monitor
- Activity and behavioral monitoring
- Robust intra-family communication
- Social networking
- Fall detector
- Robotic lifter
- …

A role for Computer Science in Healthcare

Prediction, Prevention, Diagnosis and Treatment

S. Graham Jul 2010

Network Science and Engineering (NetSE)

- Considers computer networks as complex, global socio-technical infrastructure
- Encourages researchers to reason about the dynamics and behavior of current and future large-scale networks and the interdependence among the physical, informational and communications technologies
- Promotes research in radical design in network architectures by building on the predecessor FIND Program
- Seeks to improve or enable existing or new classes of applications, such as multi-player games, virtual worlds, augmented reality and tele-presence.

Trustworthy Computing

- Builds on its predecessor program – Cyber Trust
- Supports research and education activities that explore novel frameworks, theories, and approaches toward realizing a trustworthy computing future
- Seeks new knowledge about scientific foundations of trustworthiness – reliability, security, privacy and usability -- to inform trustworthy technologies
- Encourages researchers to explore the integration of hardware, networking protocols, systems software and applications through new security architectures.
- Seeks to explore trade-offs between security and privacy
- Encourages proposals in the area of usability

Cyber-Enabled Discovery and Innovation (CDI)

- Create revolutionary science and engineering research outcomes made possible by innovations and advances in computational thinking.

- Seek ambitious, transformative, multidisciplinary research proposals within or across the following thematic areas:
  - From Data to Knowledge
  - Understanding Complexity in Natural, Built, and Social Systems
  - Building Virtual Organizations

- Deadlines:
  - Full Proposal Targets
    - Type I: December 1, 2010 – January 19, 2011
    - Type II: December 1, 2010 – January 20, 2011

Back to Basics

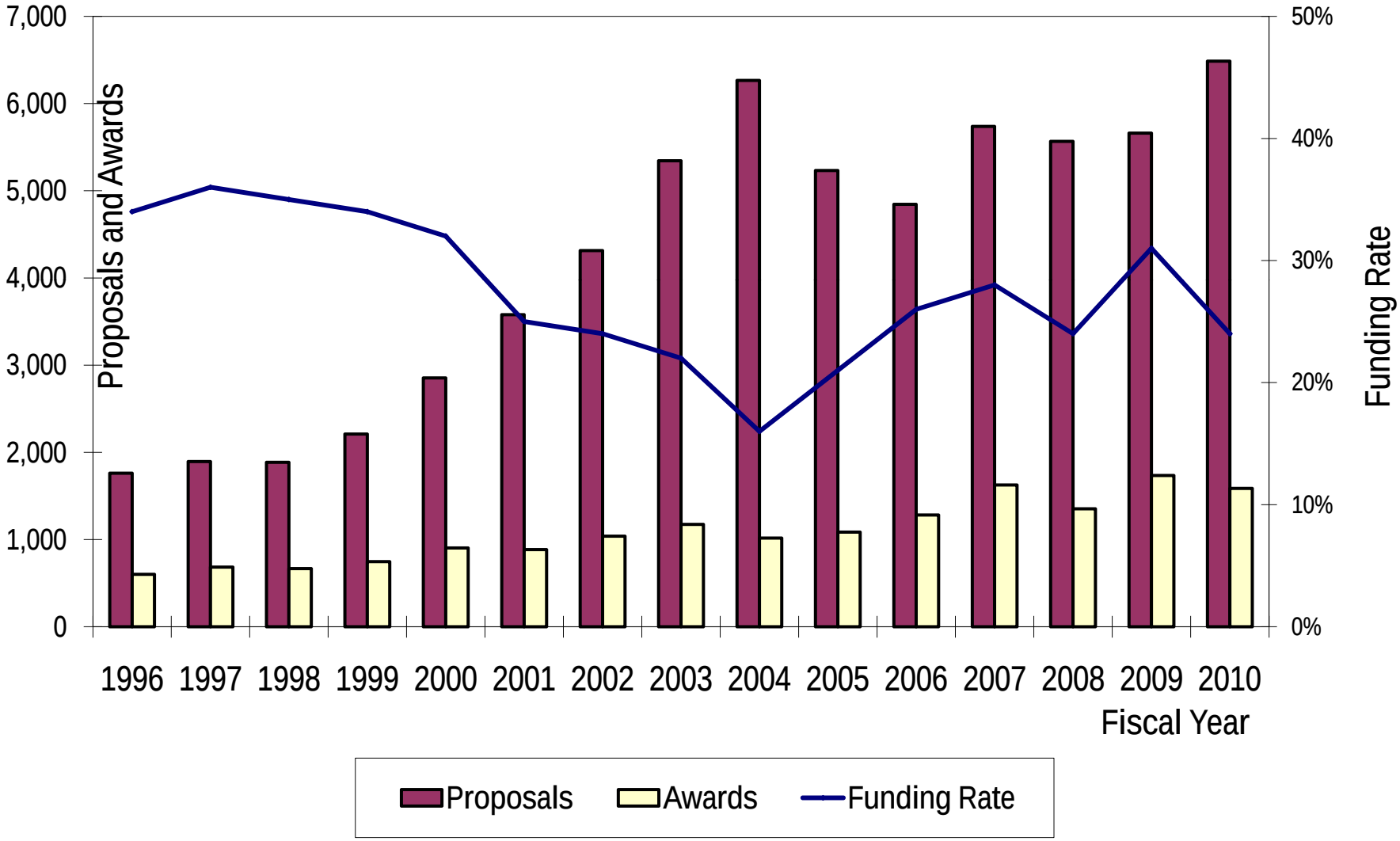
- CISE is about advancing the computing frontier
- Supporting good ideas submitted by creative people in broad range of academic institutions and organizations.
- It's about "high risk" long term impact.
  - Impact may be far in the future.
  - Impact is long-lasting (it's about new knowledge).
  - Impact can create new economies and change societal behavior.

⊘ Say "No" to incrementalism!

Proposal and Funding Statistics

FY 2010 Proposal Statistics
NSF and CISE

Statistic	NSF	CISE
No. of Proposal Actions	56,561	6,486
No. of Reviews	289,857	28,441
No. of Awards	13,015	1,585
Funding Rate	23%	24%


7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Proposals and Awards
50%
40%
30%
20%
10%
0%
Funding Rate
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Fiscal Year
Proposals
Awards
Funding Rate

Community Involvement

Highlights

Concluding Remarks

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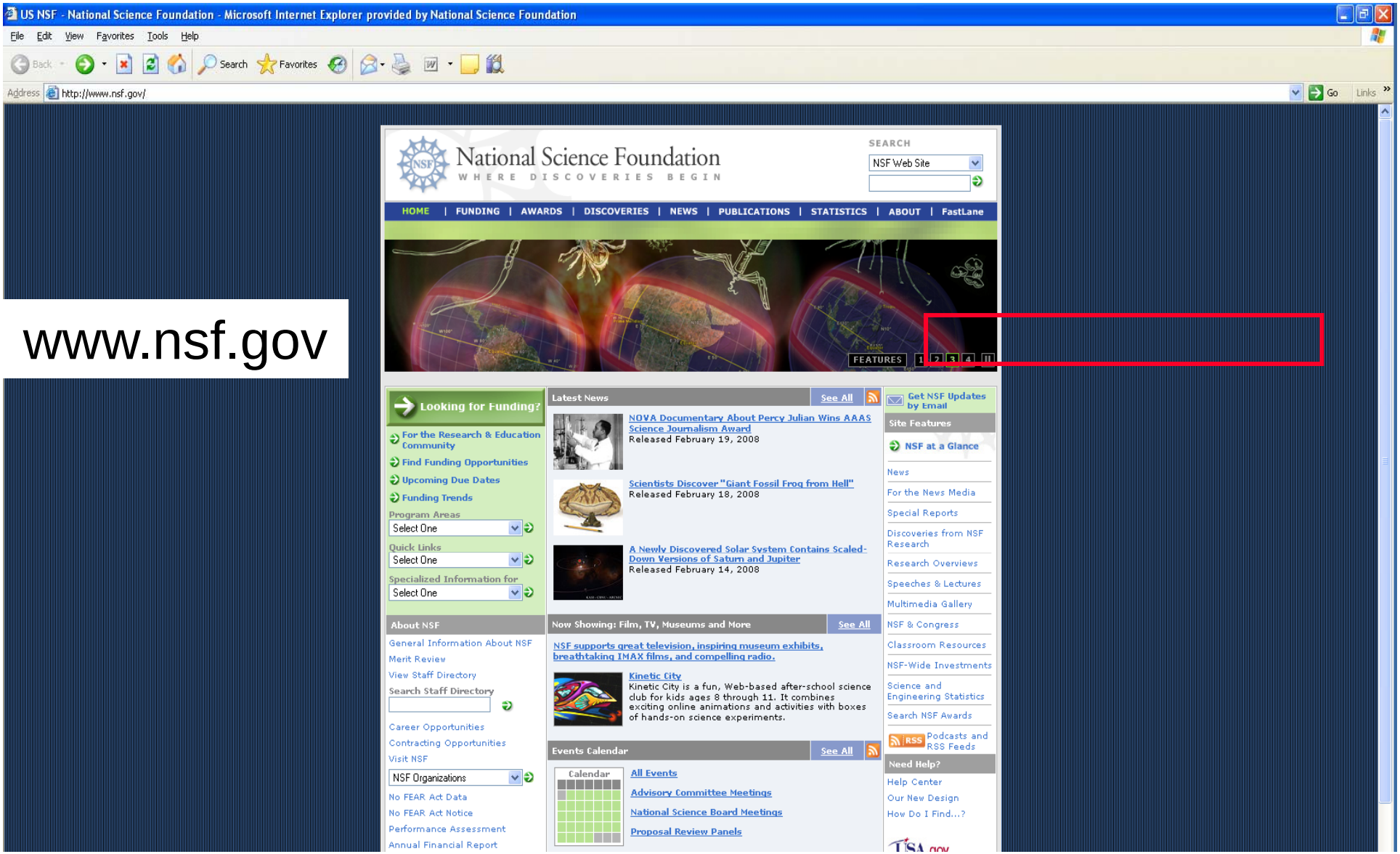


Subscribe to CISE Distribution List

CISE has implemented a mail distribution list to notify the Computer and Information Science and Engineering community of items we think may be of interest. The postings will be infrequent and brief and will typically point to further information on our website. This may duplicate some of the items contained in NSF Custom News Service but will also contain items not always available there:

Announcements, vacancy notices, CISE webcasts of interest, meeting notices and news items.

To subscribe: send a message to: join-cise-announce@lists.nsf.gov with no text in the subject or message body.

If you no longer wish to be included on the distribution list, you can elect to be removed from the list at any time. Instructions for unsubscribing will be included at the end of each list message.

http://www.nsf.gov/cise/news/mail_lists.jsp

Get Involved

- Send your best ideas to NSF: consistent with program focus and goals
- Volunteer to be a reviewer and panelist
- Get to know your Program Directors

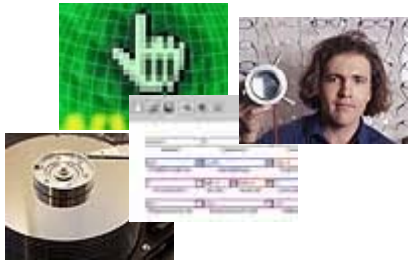
- Keep us informed of your accomplishments
- Work within your institutions to support collaborative, interdisciplinary research
- Call our attention to things that need improvement
- Suggest transition strategies from basic research to prototyping and production
- Participate in NSF-funded events, workshops, etc.
- Plan to serve as a program officer (“rotator”) or division director
- Consider participating in the Computing Community Consortium

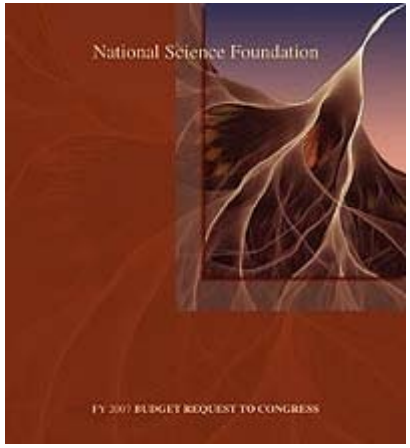
Highlights

- Succinct, interesting vignettes
  - Show a result, not an expense
  - Layman's language
  - Graphics if possible

- NSF shares Highlights publicly
  - Budget requests
  - Performance reports
  - Public relations

- Convince the US public that research is worth paying for





Concluding Remarks

- CISE-funded research and education outcomes are *essential* to national competitiveness and a growing US economy.
- Research focus should be on big, bold ideas!
- We seek potentially transformative research
  - Fundamental questions in computing
  - Potential for significant, enduring impact
  - Plausible, but high risk projects
- We encourage multi-disciplinary research in many of our programs as well as research in core computing areas.
- We encourage more research on computing education and cyberlearning!
- We encourage participation in GENI.