NSF Directorate for Computer and Information Science and Engineering (CISE)

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Outline

- Background on NSF
- CISE Organization
  - Divisions, Clusters, Programs
  - FY 2006 activities; FY 2007 plans
- CISE Emphasis Areas/Programs
  - Cybertrust
  - Science of Design
  - Broadening Participation
- Other programs (CAREER, IGERT, REU, RUI)
- GENI Initiative

NSF Mission

To promote the progress of science;

to advance the national health, prosperity, and welfare;

and to secure the national defense.

NSF Strategic Goals

- **People**:

  to develop a diverse, internationally competitive and globally-engaged workforce of scientists, engineers, and well-prepared citizens

- **Ideas**:

  to provide a deep and broad fundamental science and engineering knowledge base

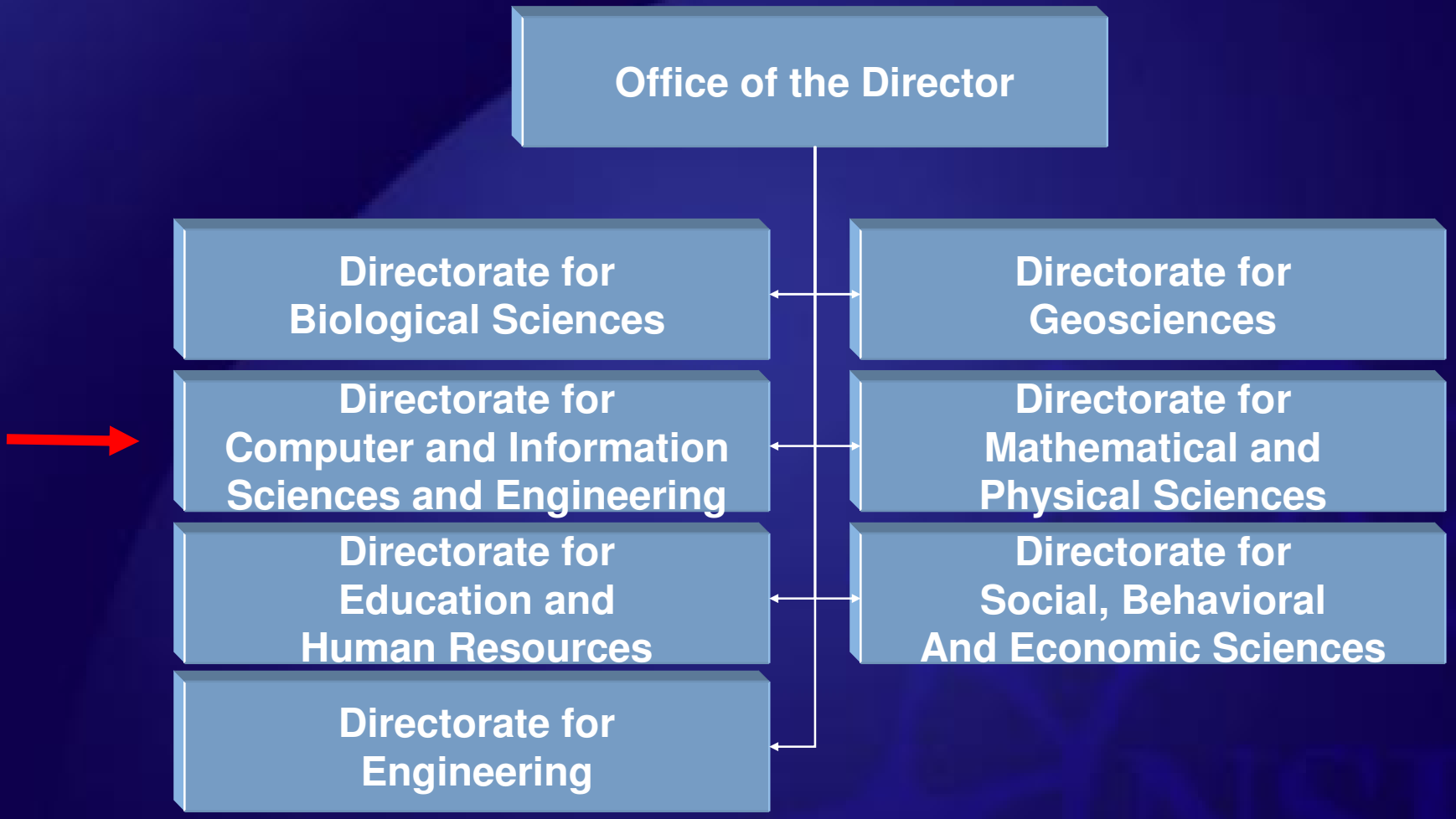
- **Tools**:

  to provide widely accessible, state-of-the-art science and engineering archives, tools, and infrastructure

- **Organization Excellence**:

  to develop an agile, innovative organization that fulfills its mission through leadership in state-of the-art business practices

NSF Organization



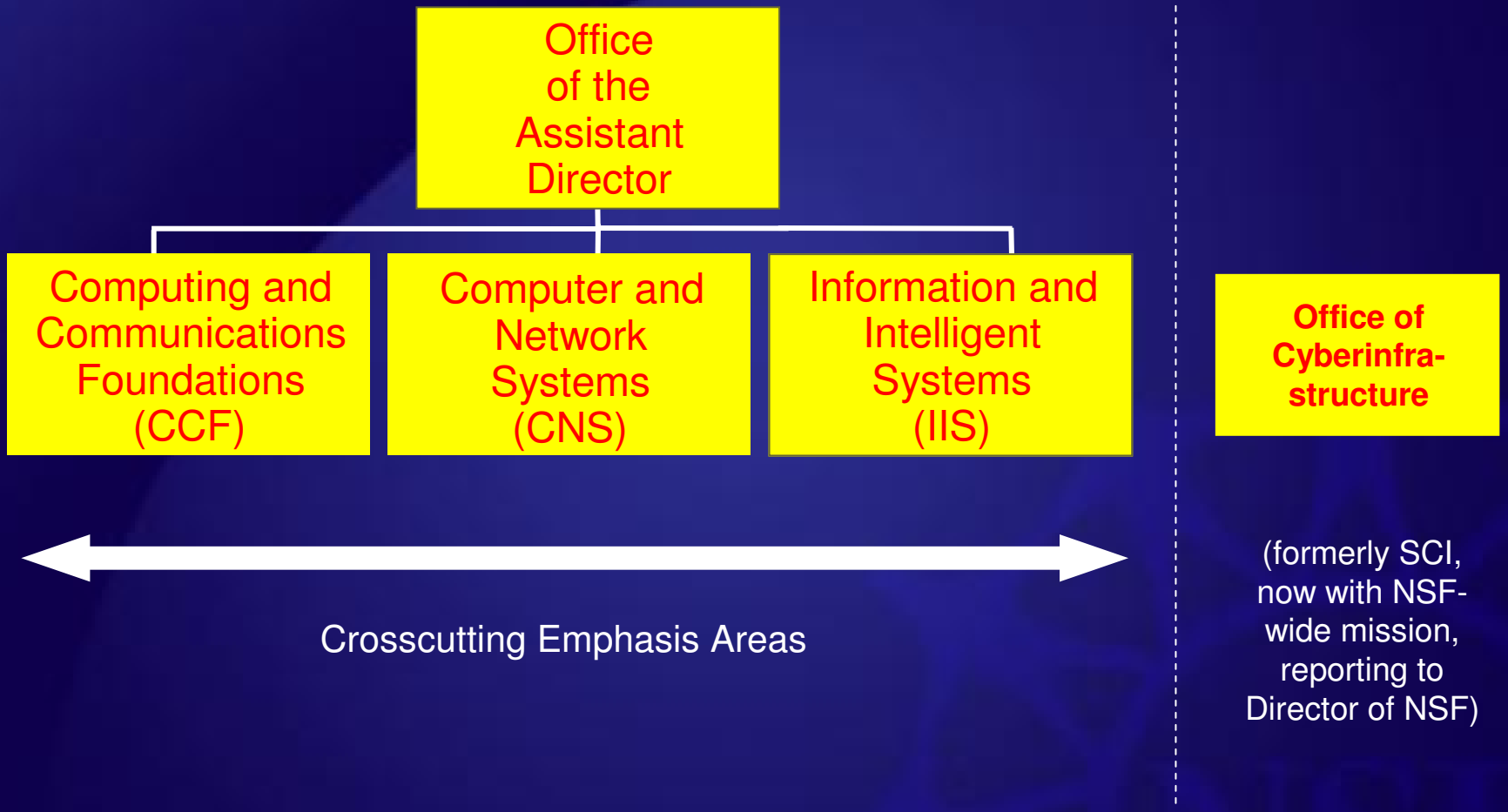
CISE Mission

- CISE has three goals:
  - To uphold a position of world leadership in computing, communications and information science and engineering
  - To promote the understanding of the principles and advance uses of computing, communications and information systems in service to society
  - To contribute to universal, transparent and affordable participation in an information-based society

CISE Strategic Objectives

- Push the Frontiers of Computer Science
- Advanced Applications
- Research for cyberinfrastructure
- Broaden participation
- Improve organizational effectiveness

Current CISE Organization



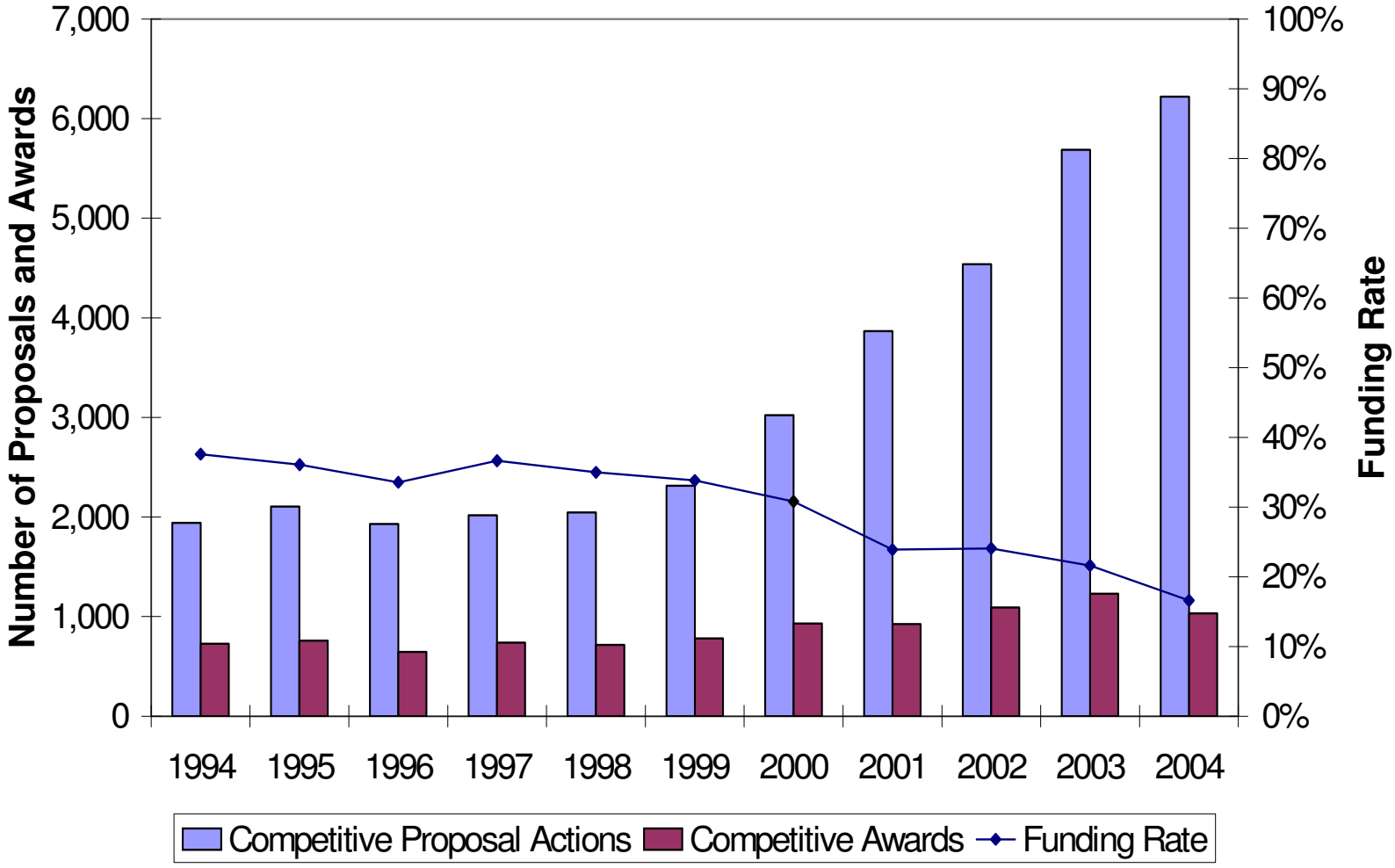
CISE FY 06 Budget

	FY 2006
CCF Division	$ 91M
CNS Division	$132M
IIS Division	$ 93M
ITR (not a division; cross-CISE)	$174M
CISE Total	*$490M*
OCI	$124M

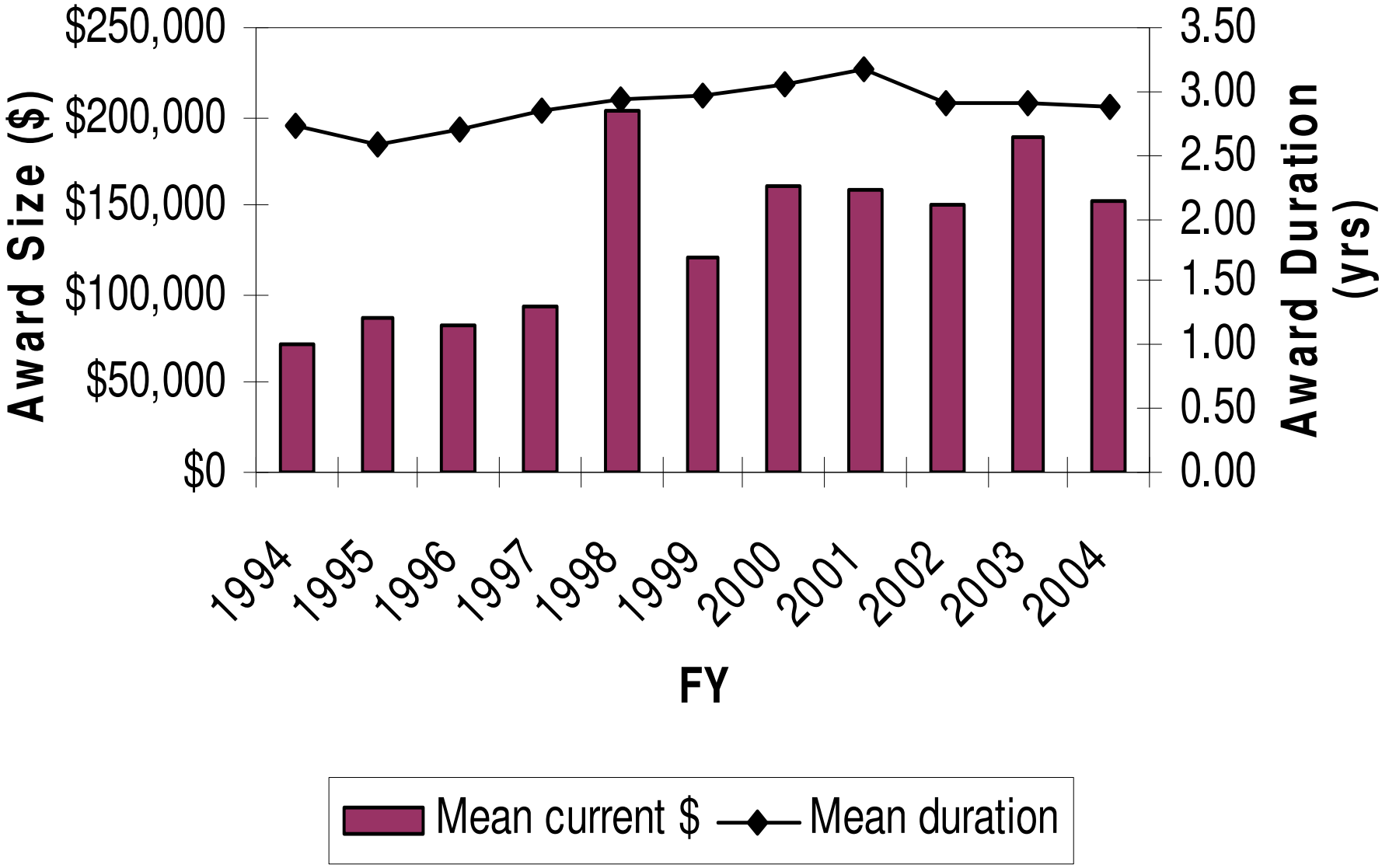
Funding Outlook

- NSF funds available to support computing have nearly doubled in the past five years
- However, proposals have almost tripled
- From less than one per year per CS faculty member to more than one per year
- Greatly expanded scope of research

Funding Rate for Competitive Awards in CISE



Average Annual Award Size and Duration in CISE



Computing and Communication Foundations Division (CCF)

- Theoretical Foundations
  - Computer science theory; numerical computing; computational algebra and geometry; signal processing and communication
- Foundations of Computing Processes and Artifacts
  - Software engineering; software tools for HPC; programming languages; compilers; computer architecture; graphics and visualization
- Emerging Models and Technologies for Computation
  - Computational biology; quantum computing; nano-scale computing; biologically inspired computing

Computer and Network Systems Division (CNS)

- Computer Systems
  - Distributed systems; embedded and hybrid systems; next-generation software; parallel systems
- Network Systems
  - Networking research broadly defined plus focus areas
- Computing Research Infrastructure
  - Equipment and infrastructure to advance computing research
- Education and Workforce
  - IT workforce; special projects; cross-directorate activities (e.g., REU sites, IGERT, ADVANCE)

Information and Intelligent Systems (IIS)

- Robust Intelligence
  - Artificial Intelligence
  - Natural Language Processing
  - Robotics
  - Computer Vision
  - Cognition
- Information Integration and Informatics
  - Data, Information, and Knowledge Management
  - Information Integration
  - Science and Engineering Informatics
  - Digital government and digital libraries
- Human-centered Computing
  - Human Computer Interaction,
  - Social Informatics
  - Universal Access
- Other cross-cutting programs
  - Neuroscience (joint program with NIH)
  - Advanced Learning Technologies (joint program with EHR)

CISE Cross-Cutting Emphasis Areas

- Characteristics
  - cut across clusters and divisions (and directorates)
  - address scientific or national priority
- FY 2006 Emphasis Areas
  - Science of Design: January 6, 2006
  - Cyber Trust: February 6, 2006
  - Broadening Participation: April 5, 2006

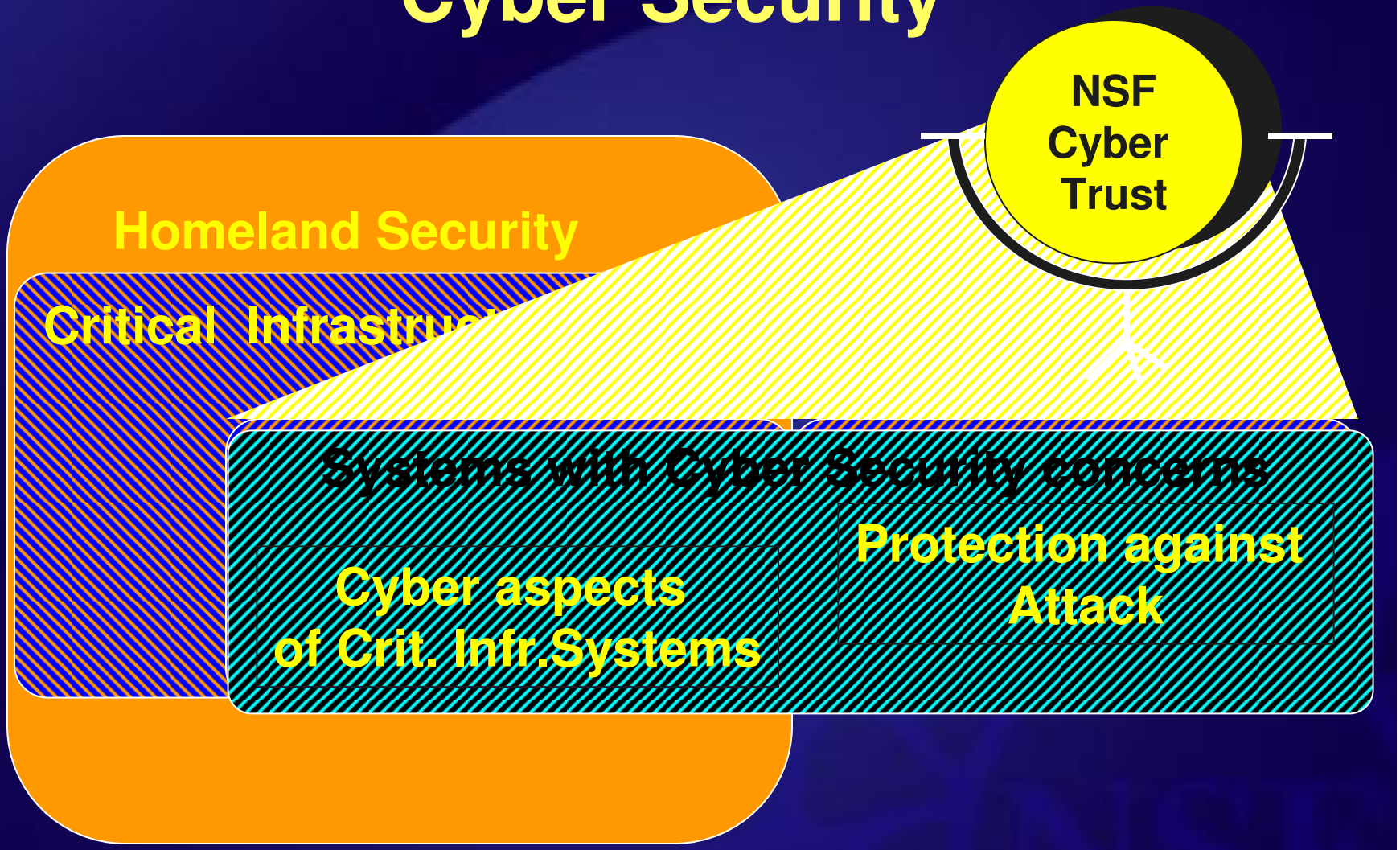
CyberTrust

- Vision: A society in which
  - Computing systems operate securely and reliably
  - Computing systems protect sensitive information
  - Systems are developed and operated by a well-trained and diverse workforce
- Research on foundations, network security, systems software, and information systems
- Integrated education and workforce activities

NSF's Role

- Assure nation's needs for basic scientific research met
  - Infrastructure for cybersecurity research: equipment and data
  - People trained to perform the research
- Assure nation can produce workforce with needed skills
  - Scholarships for Service - EHR/DUE
- Study security and privacy – CISE/IIS
- Study social/political/economic aspects
  - Economics, e-voting – with Digital Government and SBE
- National and international coordination and cooperation

Critical Infrastructure and Cyber Security



Cyber Trust

- FY 2005 competition
  - ~500 proposals received in February 2005
  - 39 awards for $36M
- FY 2006 competition
  - Proposals were due: February 6, 2006
  - Estimated number of awards: 35-47 (Up to 2 center-scale awards, up to 20 team awards, and up to 25 single investigator awards will be made, dependent on availability of funds)
  - Anticipated Funding Amount: $30M

Science of Design

- *About* Computing: computers, computation, information, communication
- *Not about:* buildings, bridges, airplane wings, traditional engineering design, nano, biotech, ..
- However: desirable to import design research from other fields
- How is "software" different from other materials from which artifacts are designed?
- How is design of (distributed, embedded, heterogeneous,…) systems different or the same as design of other artifacts?

Science of Design

- FY 2005 competition
  - Proposals received in May 2004
  - Projects up to $300,000/year for 3 to 5 years
  - Received ~ 190 proposals (~160 projects)
  - Made 16 awards, project success rate of ~10 %
  - ~ $10 million invested
- FY 2006 competition
  - Proposals were due: January 6, 2006
  - Estimated Number of Awards: 20 to 30
  - Anticipated Funding Amount: $10,000,000

Science of Design Solicitation Information

- This year's competition will be significantly different than last year's:
  - It will encourage team projects to bring new thinking and people into the effort
  - It will lay a fundamental basis for the creation of software-intensive systems

Broadening Participation in Computing (BPC)Program

- The Broadening Participation in Computing (BPC) program aims to significantly increase the number of students who are U.S. citizens and permanent residents receiving post secondary degrees in the computing disciplines.
  - New Program FY05
  - Available Funds: 14 Million
  - Full Proposals due: April 5, 2006
  - Check CISE web site concerning which proposals require a Letter of Intent and due dates (Note: The Letter of Intent MUST be submitted via FastLane)

BPC Program

- Initial Emphasis will be on students from communities with longstanding under-representation in computing:
  - Women, persons with disabilities, and
  - Minorities: African Americans, Hispanics, American Indians, Alaska Natives, Native Hawaiians, and Pacific Islanders.
- Develop and implement innovative methods to improve recruitment and retention of these students at the undergraduate and graduate levels
- Develop effective strategies for identifying and supporting members of the targeted groups who want to pursue academic careers in computing

BPC Program Components

- Alliances (up to $1M/year for up to 3 years)
  - Comprehensive programs that address under-representation in the computing disciplines
  - Join academic institutions of higher learning with secondary schools, government, industry, professional societies, and other not-for-profit organizations
- Demonstration Projects (average $200k/year for 2-3yrs)
  - Demonstration Projects (DPs) are smaller in scope and narrower in focus than Alliance projects.
  - DPs will be pilots that could be incorporated into the activities of an Alliance
- Supplements

Cross-Foundational Programs

- IGERT
- REU Sites
- ADVANCE
- GK-12
- CAREER
- RUI
- RET

IGERT

- Intended to meet the challenges of educating U.S. Ph.D. scientists, engineers, and educators
- Intended to catalyze a cultural change in graduate education – for students, faculty, and institutions – by establishing innovative new models for graduate education and training
- Intended to facilitate greater diversity in student participation and preparation, and to contribute to the development of a diverse globally-engaged science and engineering workforce

REU Sites

- REU Sites are encouraged to involve students in research who might not otherwise have the opportunity, particularly those from academic institutions where research programs are limited
- Enables a cohort experience for students
- Projects may be based in a single discipline or academic department, or on interdisciplinary or multi-departmental research opportunities with a coherent intellectual theme

ADVANCE

- Increase the representation and advancement of women in academic science and engineering careers
- Increase the diversity of the science and engineering workforce
- Increase the number of underrepresented minority groups and individuals with disabilities

GK-12

- Provides fellowships and training in STEM disciplines
- Provides institutions of higher education with an opportunity to make a permanent change in their graduate programs by including partnerships with K-12 schools
- Provides educational opportunities for Graduate Students

CAREER Program

- Foundation-wide activity that offers the National Science Foundation's most prestigious awards for new faculty
- NSF supports the early career development activities of those faculty members who are most likely to become the academic leaders of the 21st century
- CAREER awards have a 5-year duration
- In FY'06, the minimum CAREER award (including indirect costs) is $400,000 for all NSF directorates

Research in Undergraduate Institutions (RUI)

- Predominantly undergrad, no more than 10 Sci/Eng PhD/yr
- Addition 5-page impact for institution
- Same review as standard proposal
- Look at Resarch Opportunity Awards (ROA) for supplements to existing NSF grants for RUI collaborators
- NSF 00-144, funds from disciplinary programs

Research Experiences for Teachers

- K-12 teachers of science and math and the NSF research community
- REU supplements
  - For teachers, up to 10K/year, 1 year supplement
- Site Program
  - From ENG, 3 years, includes community college faculty

Global Environment for Networking Innovations Initiative (GENI)

- The GENI Initiative envisions the creation of new networking and distributed system architectures that, for example:
  - Build in security and robustness;
  - Enable the vision of pervasive computing and bridge the gap between the physical and virtual worlds by including mobile, wireless and sensor networks;
  - Enable control and management of other critical infrastructures;
  - Include ease of operation and usability; and
  - Enable new classes of societal-level services and applications.

Limitations of the Internet

- Security mechanisms not included in the IP layer
- End-to-end robustness cannot be assumed or assured
- Scaling limitations exist
- Quality of service mechanisms have not diffused widely in the public Internet
- Support for new technologies difficult (e.g., wireless, mobility, sensors)

Transportation

Internet Not Ready for Its Future Roles

Critical Infrastructure

Telecommunications
Banking & Finance

Digital Living *2010*

People across the globe will have access to each other and information provided by pervasive devices, embedded sensors and systems because all will be connected to the Internet.


Games


Communications
Photography

Inventory/Sales tracking
Banking and Commerce

Entertainment Systems

Health/Medical


Home Computer
Surveillance and Security
(at home, work, or in public)
Home Appliances
PDA

Car

Telephone
Building Automation


Thanks to David Kotz at Dartmouth

GENI Components

GENI Research Program

- Supports research, design, and development of new networking and distributed systems
- Builds on many years of knowledge and experience
- Encourages researchers and designers to:
  - reexamine all networking assumptions
  - reinvent where needed
  - design for intended capabilities
  - deploy and validate architectures
  - build new services and applications
  - encourage users to participate in experimentation
  - take a system-wide approach to the synthesis of new architectures

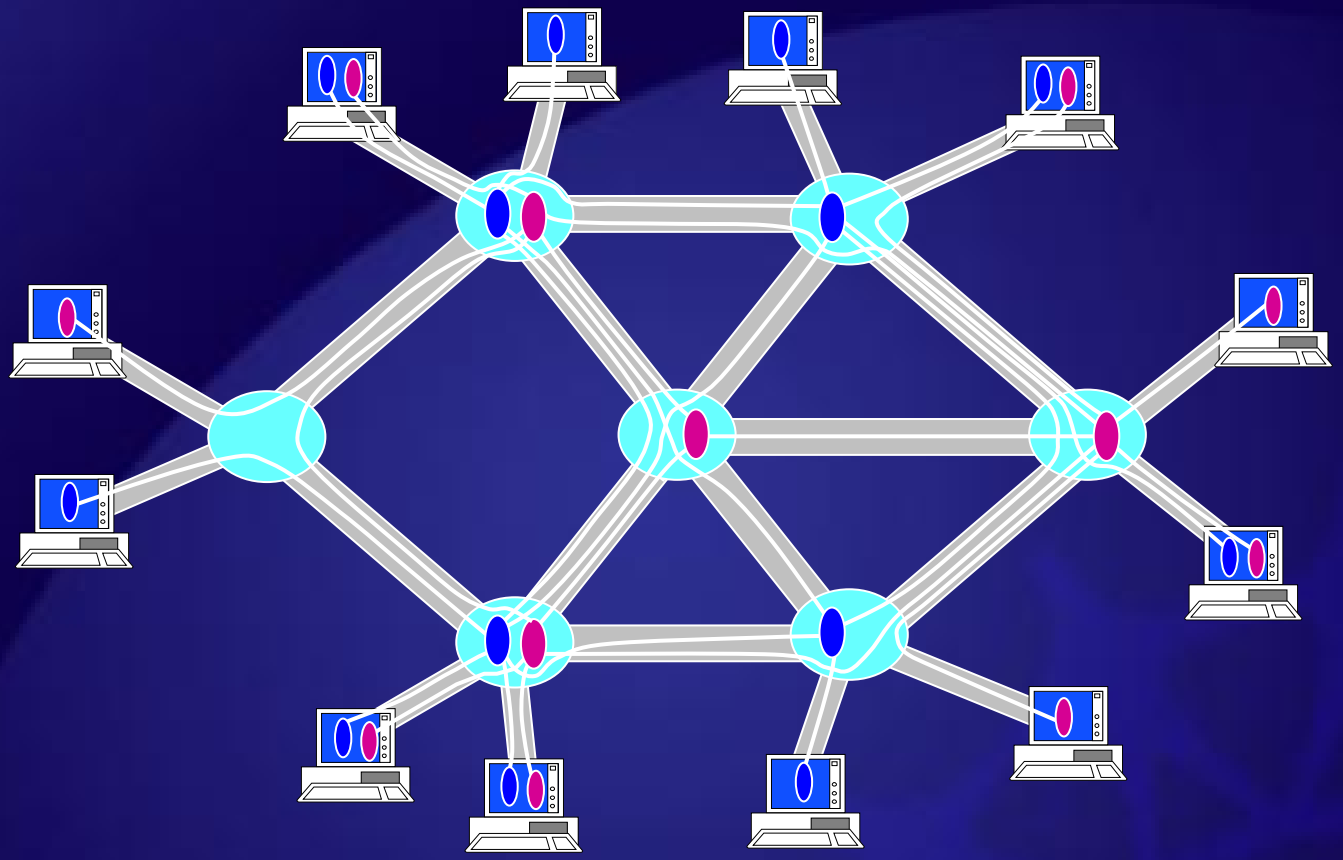
GENI Components

(continued)

The GENI Facility will enable:

- Shared use through slicing and virtualization in time and space domains (i.e., where "slice" denotes the subset of resources bound to a particular experiment);
- Access to physical facilities through programmable platforms (e.g., via customized protocol stacks);
- Large-scale user participation by "user opt-in" and IP tunnels;
- Protection and collaboration among researchers by controlled isolation and connection among slices;
- A broad range of investigations using new classes of platforms and networks, a variety of access circuits and technologies, and global control and management software; and
- Interconnection of independent facilities via federated design.

Facility Goals and Key Concepts



Goal: shared platform that promotes innovations

Key Concepts: Slicing, Virtualization, Programmability

GENI Outreach

- CISE has supported numerous community workshops in support of GENI
- CISE is supporting on-going planning efforts, including needs assessment and requirements for the GENI Facility.
- CISE will hold town meetings and continue to support future workshops to broaden community participation.
- CISE will work with industry, other US agencies, and international groups to broaden participation in GENI beyond NSF and the US government.

Help from the Community

- Send your best ideas to NSF
  - Consistent with focus & goals of the program
  - We want high risk / high reward proposals
- Suggest and encourage good panelists who can do justice to the proposals and our focus
- Volunteer to be a reviewer or a panelist
- Come to NSF as a Program Officer

Conclusion

- NSF's role is fundamental to all areas of our society - the most basic future investment
- Computer science and related disciplines are very important in their own right and essential to advancement in all areas of S&E
- NSF and our field are facing unprecedented pressures that can only be overcome by concerted, cooperative action

Thank you

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visit the CISE web site at
http://www.nsf.gov/cise