

# Computer & Information Science & Engineering



Nov 2016

<http://www.nsf.gov/dir/index.jsp?org=CISE>



# National Science Foundation's Mission

*“To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense...”*

NATIONAL SCIENCE FOUNDATION



The National Science Foundation is vital because we support **basic research** and **people** who make **discoveries** that **transform our future** by:

- driving the **U.S. economy**,
- enhancing our **nation's security**, and
- giving the U.S. the competitive edge to remain a **global leader**.





National Science Foundation

# GOLD STANDARD IN MERIT REVIEW

Research proposals submitted to NSF are subjected to a rigorous merit review system – impartial, competitive, and transparent – ensuring that each proposal meets the highest standards of intellectual merit and broader impact on society. NSF’s merit review process is widely regarded as the gold standard of scientific review and has been emulated in numerous countries around the world.

**\$7.3 billion** NSF FY 2015 Budget Request

**94%** Funds research, education and related activities

## INPUT



**50,000**

Proposals evaluated through competitive review process



**38,000**

Reviewers, including external experts and program staff



**233,000**

Total number of reviews, each proposal evaluated multiple times

## OUTPUT



**10,800**

Competitive awards funded



**1,922**

U.S. colleges, universities, and other institutions receiving NSF funding



**299,000**

Estimated number of researchers, postdoctoral fellows, trainees, teachers and students NSF supports directly

## IMPACT



**47,800**

Students supported by NSF Graduate Research Fellowships since 1952



**210+**

Number of Nobel Laureates supported by NSF



### NSF-Supported Research

has spurred economic activity and improved the quality of life for all Americans

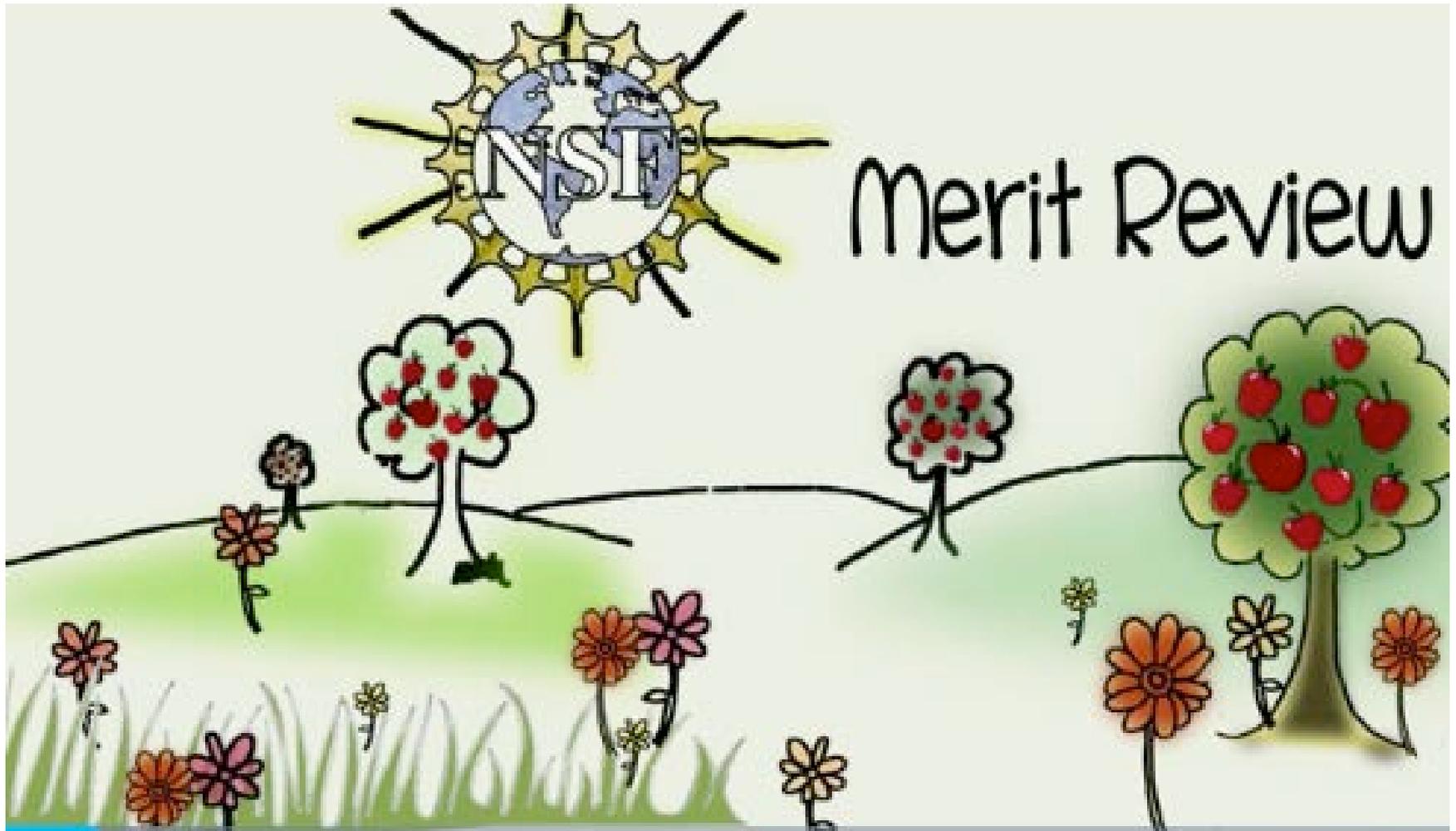


### STEM Workforce Development

supports students, teachers and tools to enable the development of a diverse and highly qualified science and technology workforce

*Figures other than Budget Request represent FY 2013 actuals*

# NSF's Merit Review Process



Video available at: <http://go.usa.gov/ceSBJ>



# NSF supports all fields of S&E



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# CISE Leadership



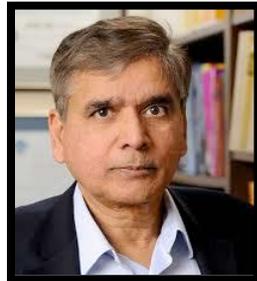
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*Erwin Gianchandani, DAD*



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(ACI)**  
*Irene Qualters, DD*



**Computing and  
Communications  
Foundations (CCF)**  
*Rao Kosaraju, DD*



**Computer and  
Network Systems  
(CNS)**  
*Ken Calvert, DD*



**Information and  
Intelligent Systems  
(IIS)**  
*Lynne Parker, DD*



# CISE's Economic and Societal Context

- CISE is at the center of an ongoing societal transformation and will be for decades to come.
- Advances in computing, communications and information technologies, and cyberinfrastructure:
  - accelerate the pace of discovery and innovation; and
  - are crucial to achieving national and societal priorities.



Image Credit: ThinkStock

**(Cyber) Security**



Image Credit: C. Min Lin, UT, Austin

**Education & Lifelong Learning**



Image Credit: NASA

**Environment**



Image Credit: Public domain

**Health & Wellbeing**



Image Credit: Nicole Fuller, NSF

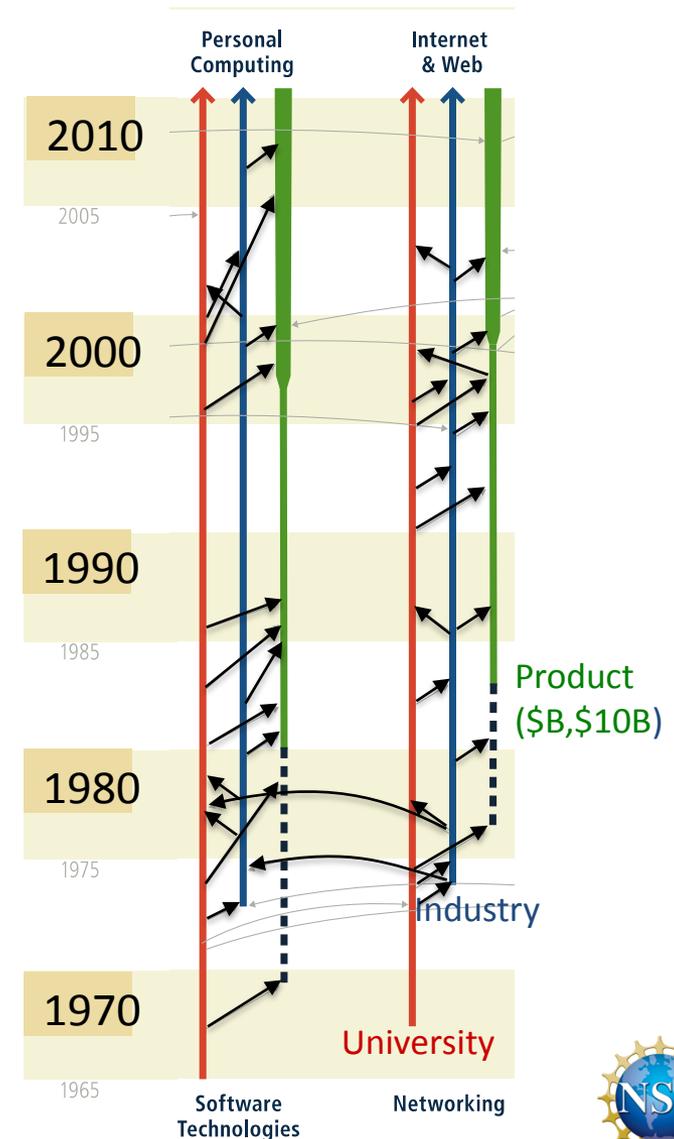
**Smart & Connected Communities**



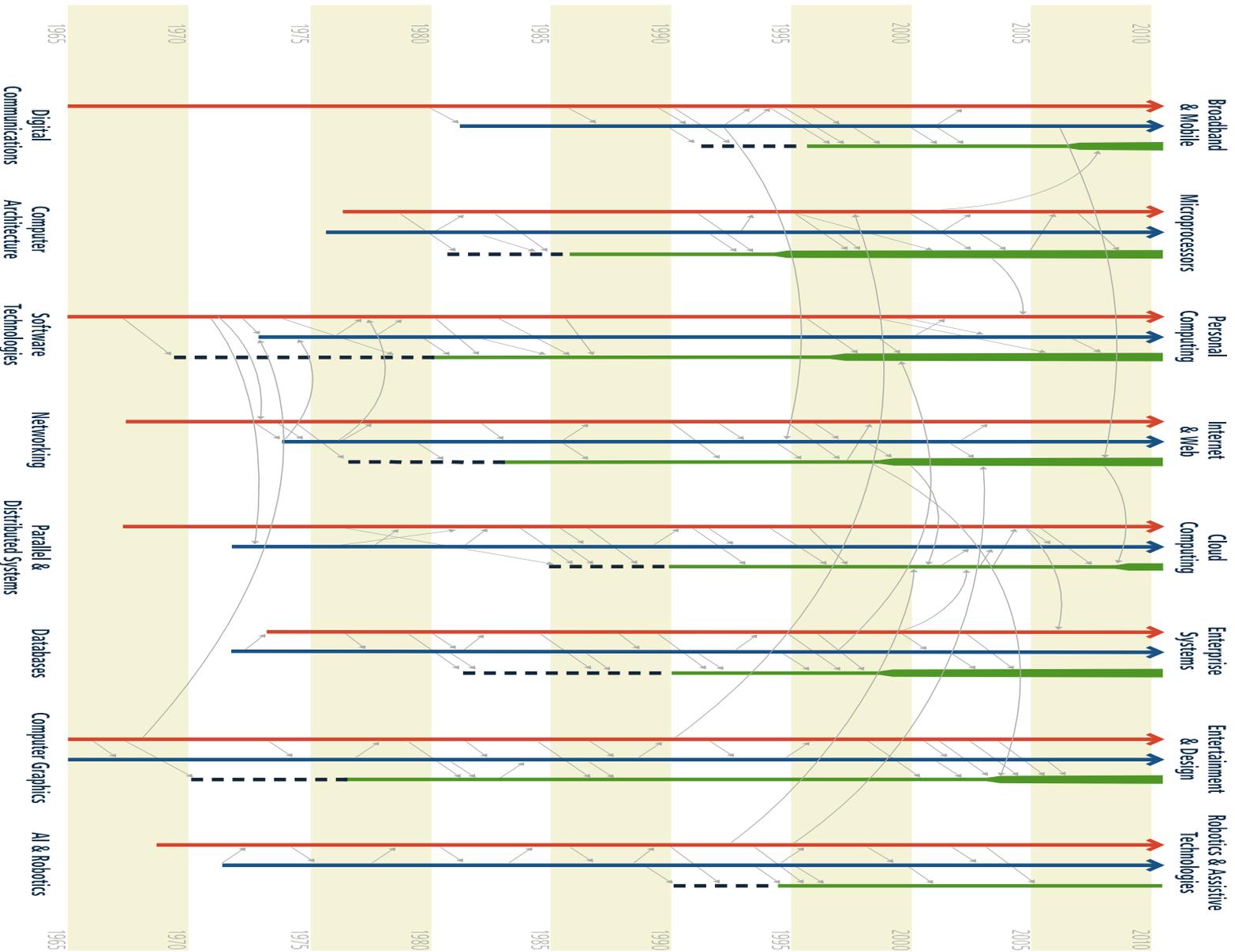
# Economic impact of CISE: From Federally-funded research to billion dollar industries

Advances in computing, communications and information technologies, and cyberinfrastructure:

- drive U.S. competitiveness, (e.g., IT accounts for 25% of economic growth since 1995), and
- have profound impacts on our daily lives.



# .... across many industries



- Motorola
- Qualcomm
- Texas Instruments
- AMD
- Intel
- Nvidia
- Apple
- Dell
- ebay
- Alamai
- Yahoo!
- Cisco
- Amazon
- Google
- Microsoft
- IBM
- VMware
- HP
- Oracle
- Electronic Arts
- Adobe
- Autodesk
- Xbox
- Nuance
- Robot
- Inuitive Surgical
- iPhone
- ipod
- Apple
- Symantec
- Juniper
- Facebook
- Twitter



# ... and this impact will continue

## Top twelve economically disruptive technologies (by 2025)

	<b>Mobile Internet</b>		<b>Next-generation genomics</b>
	<b>Automation of knowledge work</b>		<b>Energy storage</b>
	<b>The Internet of Things</b>		<b>3D printing</b>
	<b>Cloud technology</b>		<b>Advanced materials</b>
	<b>Advanced robotics</b>		<b>Advanced oil and gas exploration and recovery</b>
	<b>Autonomous and near-autonomous vehicles</b>		<b>Renewable energy</b>

SOURCE: McKinsey Global Institute analysis

McKinsey&Company

McKinsey Global Institute

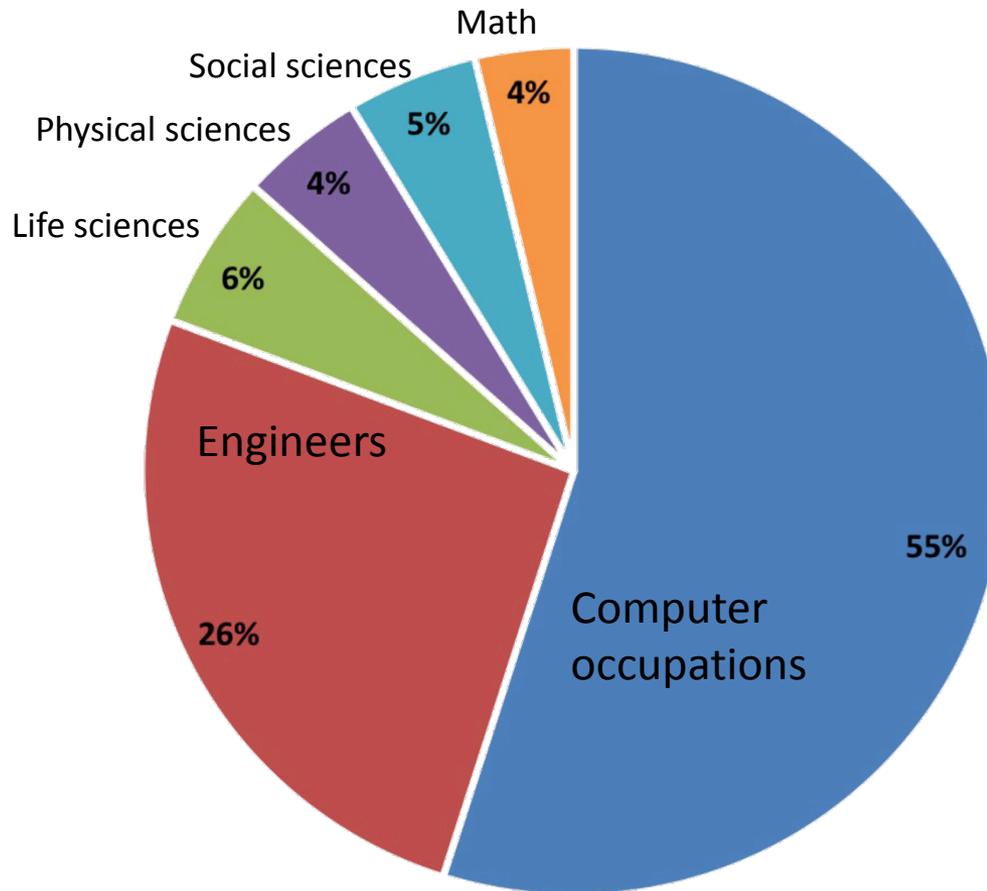


May 2013

Disruptive technologies:  
Advances that will  
transform life, business,  
and the global economy



# Many STEM jobs are in computing



Job Openings 2014 – 2024 (growth and replacement)

US Bureau of Labor Statistics



# An *amazing* time for computing!

## Ubiquity

Computing is *everywhere* – across all of science and engineering, and all of society.

## Engagement

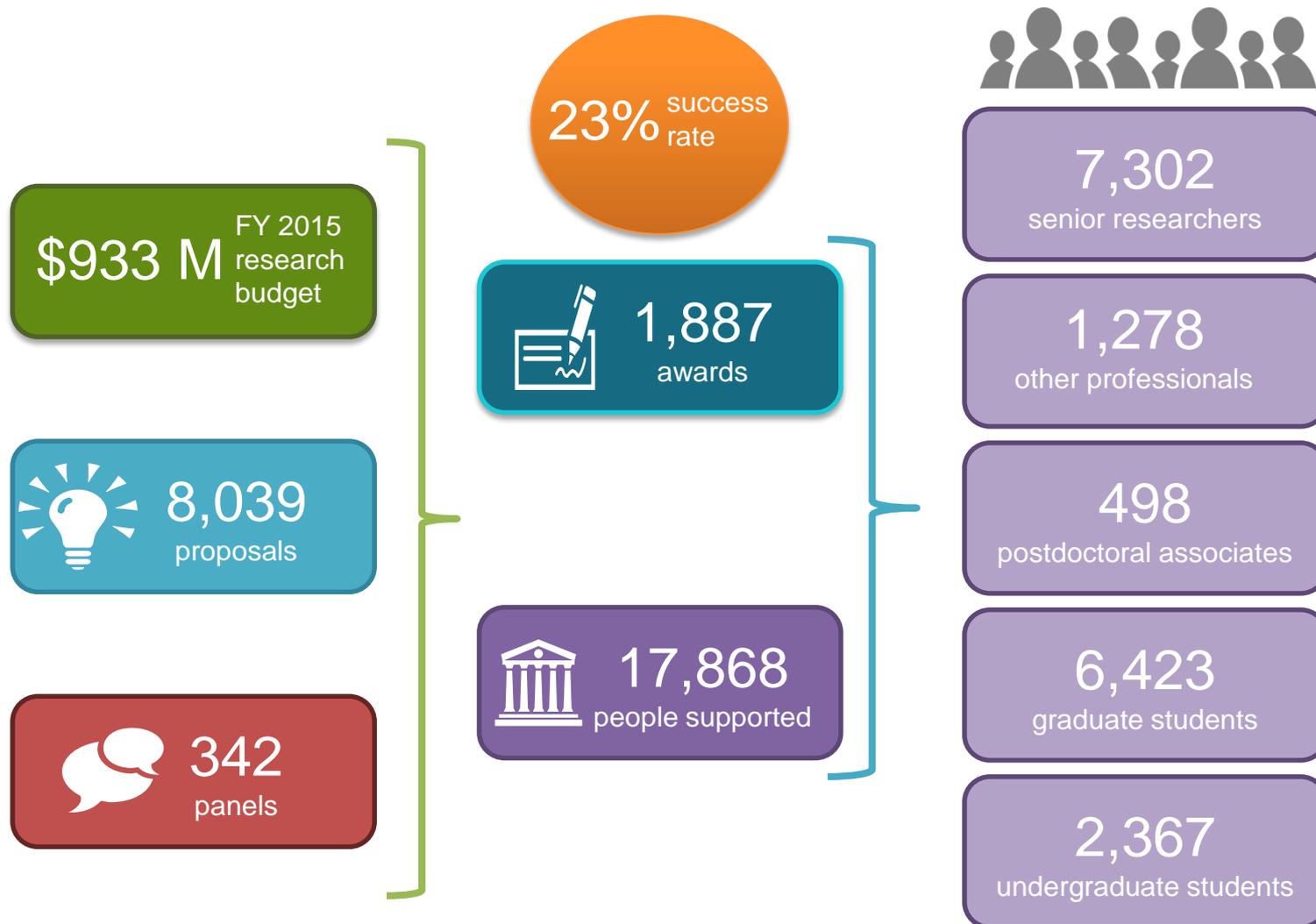
Computing intertwines with many *communities*.

## Urgency

Computing is *rapidly expanding and evolving*; there is tremendous opportunity ... *now!*

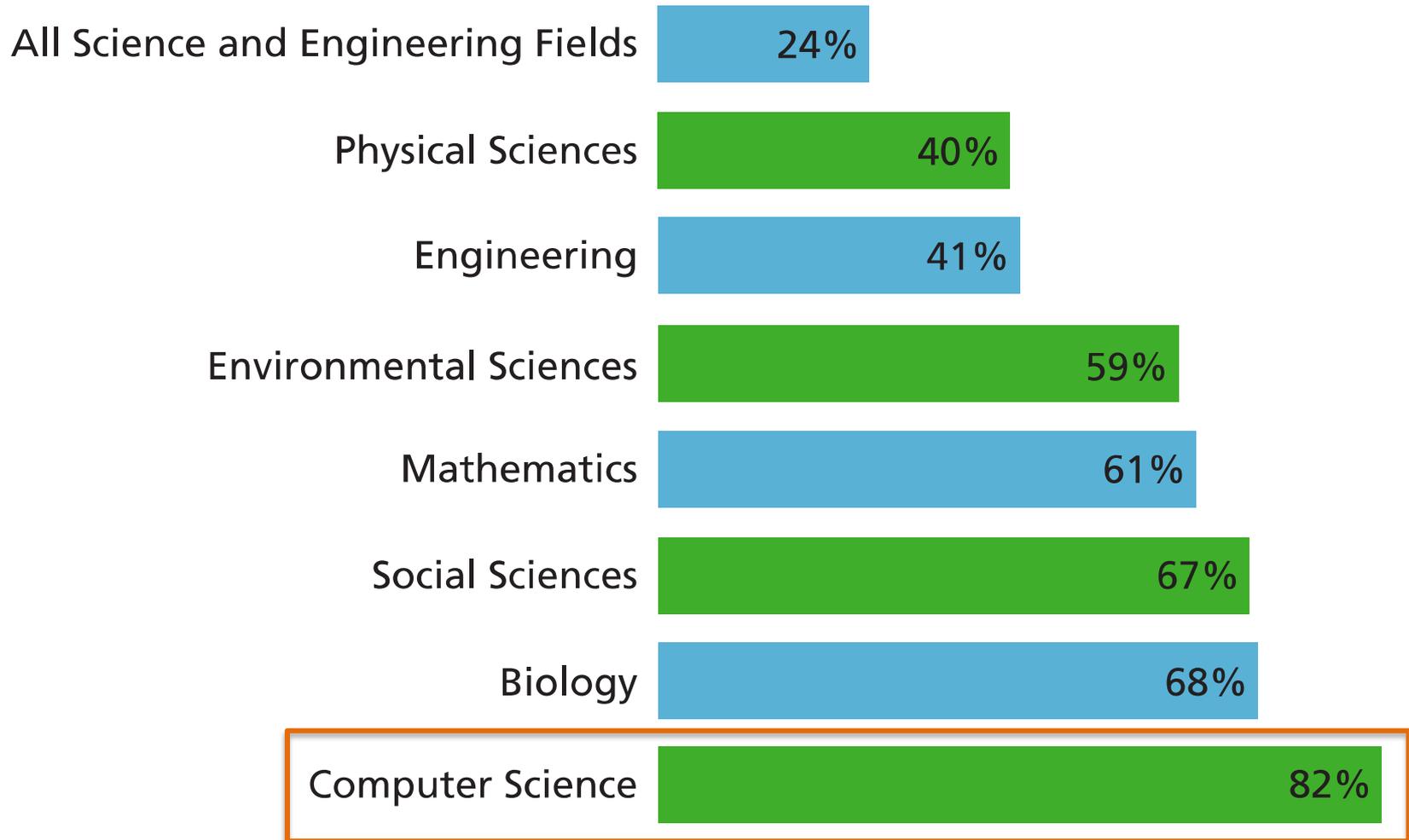


# CISE by the Numbers: FY 2015



# NSF Support of Academic Basic Research

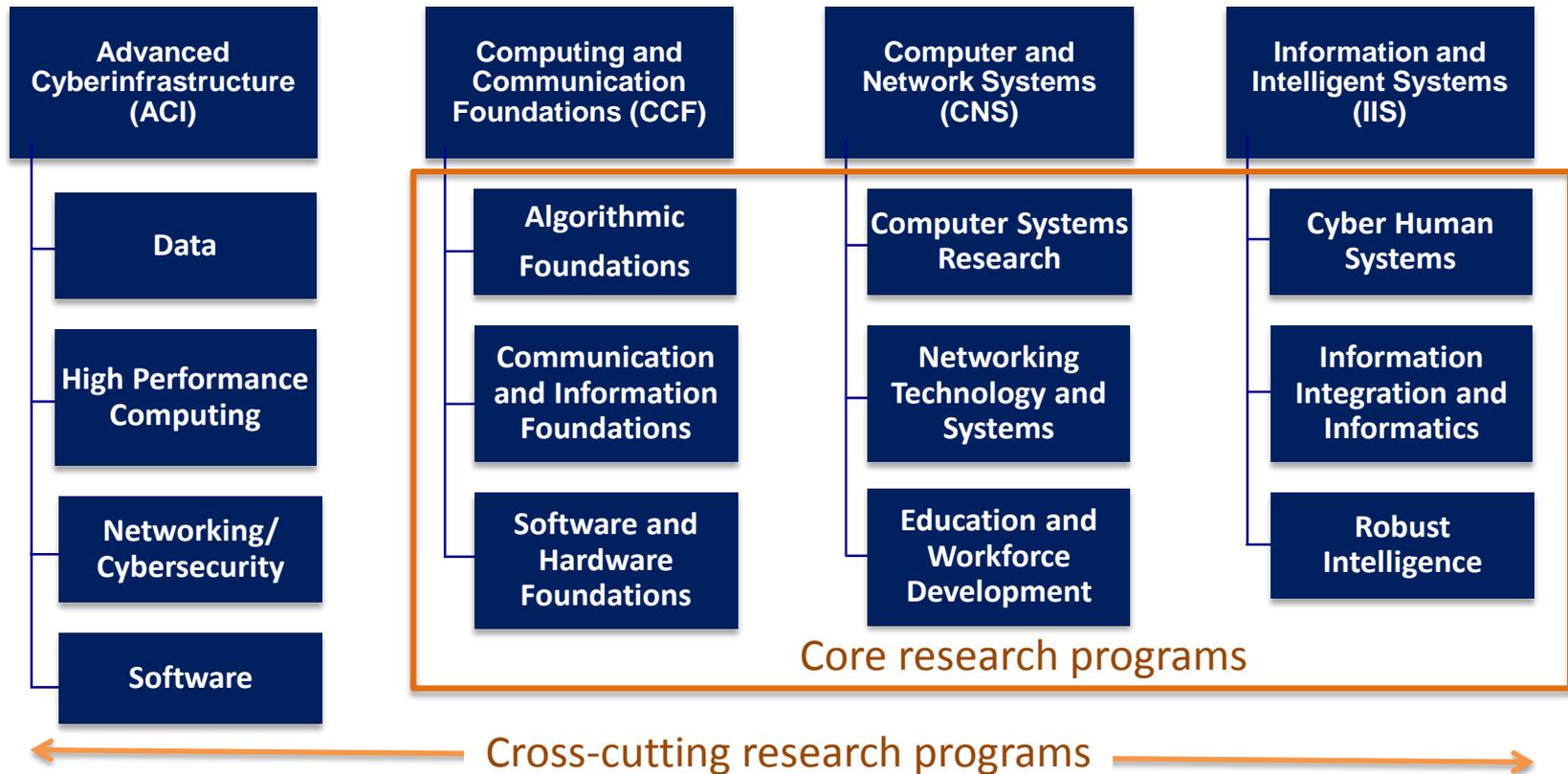
*(as a percentage of total federal support)*



# CISE Research Investments

*Exploring the frontiers of computing*

- Strong commitment to core/fundamental research – the heart of what we do.
- Cast a broad net & let the best ideas surface.
- Engage with our community to develop new research directions.



# CISE Divisions



Advanced Cyberinfrastructure

**Advanced Cyberinfrastructure** supports and coordinates the development, acquisition, and provision of state-of-the-art cyberinfrastructure resources, tools and services essential to the advancement and transformation of science and engineering.



Computing & Communication Foundations

**Computing and Communication Foundations** advances computing and communication theory, algorithms for computer and computational sciences and architecture and design of computers and software.



Computer & Network Systems

**Computer and Network Systems** invent new computing and networking technologies and finds new ways to make use of current technologies.



Information & Intelligent Systems

**Information and Intelligence Systems** studies the interrelated roles of people, computers, and information to increase our ability to understand data, as well as to mimic the hallmarks of intelligence in computational systems



# Advanced Cyberinfrastructure (ACI)

<http://www.nsf.gov/div/index.jsp?div=ACI>

**Supports the acquisition, development, and provision of state-of-the-art cyberinfrastructure resources, tools, and services essential to the conduct of 21<sup>st</sup> century science and engineering research and education.**

- *Data*: Support scientific communities in the sharing and archiving of, as well as computing with data by creating building blocks to address common community needs in data infrastructure.
- *High Performance Computing*: Enable petascale computing; provide open-science community with state-of-the-art HPC assets ranging from loosely coupled clusters to large scale instruments; develop an integrated scientific HPC environment.
- *Networking and Cybersecurity*: Invest in campus network improvements and re-engineering to support a range of activities in modern computational science. Support transition of cybersecurity research to practice.
- *Software*: Transform innovations in research and education into sustained software resources that are an integral part of cyberinfrastructure.
- *Learning and Workforce Development*: Invest in educational and training programs to meet current and future needs of CI professionals, developers, and users.



# Computing & Communication Foundations (CCF)

<http://www.nsf.gov/div/index.jsp?org=CCF>

**Supports research and education projects that explore the foundations of computing and communication devices.**

- *Algorithmic Foundations (AF)*: Innovative research characterized by algorithmic thinking and algorithm design, accompanied by rigorous mathematical analysis.
- *Communications and Information Foundations (CIF)*: Transformative research addressing the theoretical underpinnings and current and future enabling technologies for information acquisition, transmission, and processing in communication and information networks.
- *Software and Hardware Foundations (SHF)*: Foundational research essential to advance the capability of computing systems, including software and hardware components, systems, and other artifacts.



# Computer and Network Systems (CNS)

<http://www.nsf.gov/div/index.jsp?div=CNS>

**Supports research and education activities inventing new computing and networking technologies and exploring new ways to make use of existing technologies.**

- *Computer Systems Research (CSR)*: Transformative research on fundamental scientific and technological advances leading to the development of future generation computer systems, including new architectures; distributed real-time embedded devices; pervasive, ubiquitous and mobile computing; file and storage systems; operating systems; reliable, fault-tolerant and secure hard/middle/software.
- *Networking Technology and Systems (NeTS)*: Transformative research on fundamental scientific and technological advances leading to the understanding, development, engineering, and management of future-generation, high-performance computer networks.



# Information and Intelligent Systems (IIS)

<http://www.nsf.gov/div/index.jsp?div=IIS>

**Supports research and education activities that study the inter-related roles of people, computers, and information.**

- *Cyber-Human Systems (CHS)*: Research to accelerate the creation and understanding of the complex and increasingly coupled relationships between humans and computing with the broad goal of advancing human capabilities: perceptual and cognitive, physical and virtual, social and societal.
- *Information Integration and Informatics (III)*: Information technology research on the processes and technologies involved in creating, managing, visualizing, and understanding diverse digital content in circumstances ranging from individuals through groups, organizations, and societies, and from individual devices to globally-distributed systems, and that can transform all stages of the knowledge life cycle.
- *Robust Intelligence (RI)*: Research that encompasses all aspects of the computational understanding and modeling of intelligence in complex, realistic contexts to advance and integrate the traditions of artificial intelligence, computer vision, human language research, robotics, machine learning, computational neuroscience, cognitive science, and related areas.



# CISE programs to address national priorities



Image Credit: CCC and SIGACT/CATCS

**Big Data**



Image Credit: ThinkStock

**Cybersecurity**

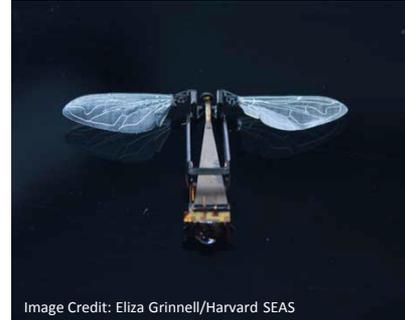


Image Credit: Eliza Grinnell/Harvard SEAS

**National Robotics Initiative**



Image Credit: ThinkStock

**Understanding the Brain**



Image Credit: Texas Advanced Computing Center

**National Strategic Computing Initiative**



Image Credit: US Ignite

**Smart Cities**



Image Credit: California University of Texas, Austin

**Computer Science for All**



Image Credit: WINLAB, Rutgers University

**Advanced Wireless Research**

For a comprehensive list of CISE funding opportunities, visit:

[http://www.nsf.gov/funding/pgm\\_list.jsp?org=CISE](http://www.nsf.gov/funding/pgm_list.jsp?org=CISE)



# National Big Data R&D Initiative

- Initiative launched by OSTP in March 2012
  - Major Announcements: NSF, NIH, USGS, DoD, DARPA, DOE
- Data to Knowledge to Action event hosted by OSTP November 2013
  - Encouraged public-private partnerships across the country
- NSF's strategy to address Big Data includes research, cyberinfrastructure, education and training, and community building.



# Critical Techniques, Technologies and Methodologies for Advancing Foundations and Applications of Big Data Sciences and Engineering (BIGDATA)

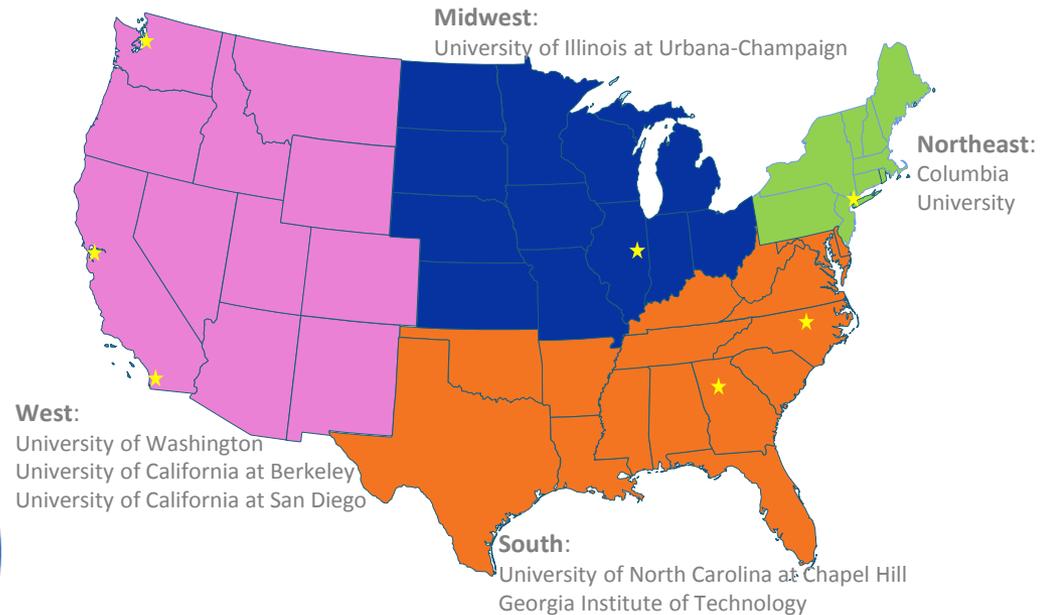
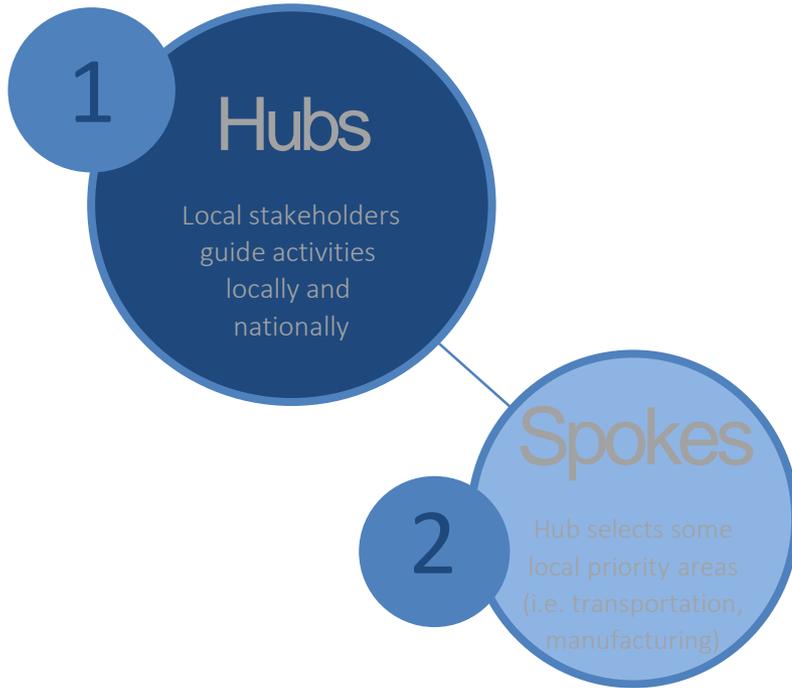
*Developing techniques to manage and analyze data*

- Cornerstone of the National Big Data R&D Initiative launched March 2012.
- Two categories for submission:
  - **Foundations:** Encourages fundamental techniques, theories, methodologies and technologies of broad applicability.
  - **Innovative Applications:** Encourages novel techniques, methodologies, and technologies of interest to at least one specific application (special requirements).
- Awards: \$200K - \$500K per year for 3 - 4 years.
- Cross-Directorate and Cross-Agency Solicitation: NSF CISE, BIO, EHR, ENG, GEO, MPS, and SBE with OFR.

Proposals due: Feb 9, 2016

# Big Data Regional Innovation Hubs & Spokes Ecosystem

*A nation-wide network for data innovation*



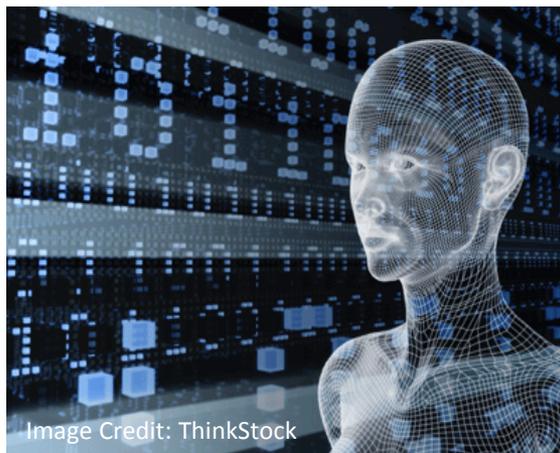
**BD Spokes: FY 2017 ~ \$8M is anticipated.**

Cross-Directorate Solicitation:  
NSF CISE, EHR, and SBE



# Secure and Trustworthy Cyberspace (SaTC)

*Securing our Nation's cyberspace*



- Aligned with 2016 Federal Cybersecurity Research and Development Strategic Plan and the National Privacy Research Strategy.
- Aims to support fundamental scientific advances and technologies to protect cyber-systems from malicious behavior, while preserving privacy and promoting usability.
- Proposal designations:
  - Core
  - Education (EDU)
  - Secure, Trustworthy, Assured and Resilient Semiconductors and Systems (STARSS), jointly offered with the Semiconductor Research Corporation (special requirements)
  - Transition to Practice (TTP)
- Cross-Directorate Solicitation: CISE, EHR, ENG, MPS, and SBE.

Proposal due dates: Fall each year, check  
NSF program page for exact dates



# National Robotics Initiative (NRI)

*Developing the next generation of collaborative robots to enhance personal safety, health, and productivity*

- NRI program launched with the National Advanced Manufacturing Partnership Initiative in June 2011.
- Aims to accelerate the development and use of collaborative robots, co-robots.
- NRI 2.0: Ubiquitous Collaborative Robots
  - Expands the scale and variety of collaborative interactions
  - Cross-Directorate and Cross-Agency Solicitation: NSF CISE, EHR, ENG, and SBE with DOD, DOE, and USDA.



Proposals due: Feb 2, 2017



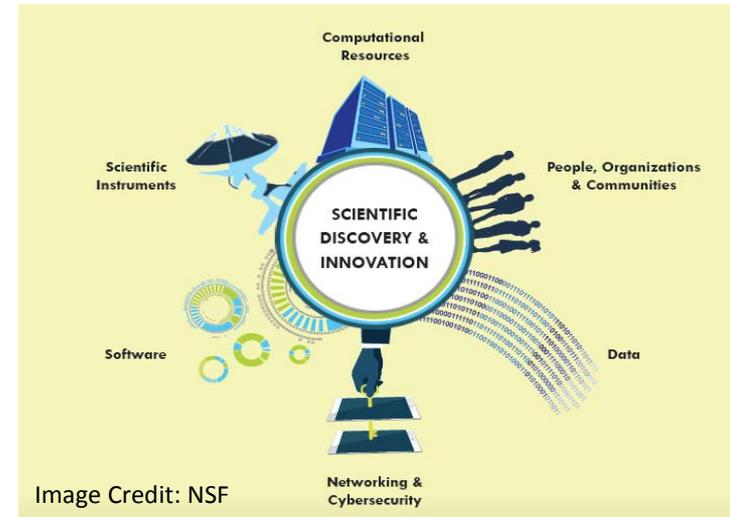
# BRAIN: Brain Research through Advancing Innovative Neurotechnologies

- White House BRAIN Initiative launched in April 2013 (NSF, NIH, DARPA).
- Addresses critical challenge of research integration across multiple scales ranging from molecular to behavioral levels with the ultimate goal of understanding the brain.
- CISE programs:
  - Collaborative Research in Computational Neuroscience (CRCNS) in collaboration with NIH, Germany, France, and Israel;
  - Integrative Strategies for Understanding Neural and Cognitive Systems (NSF-NCS) with CISE, EHR, ENG, and SBE; and
  - CISE Robust Intelligence Core Research.



# National Strategic Computing Initiative (NSCI)

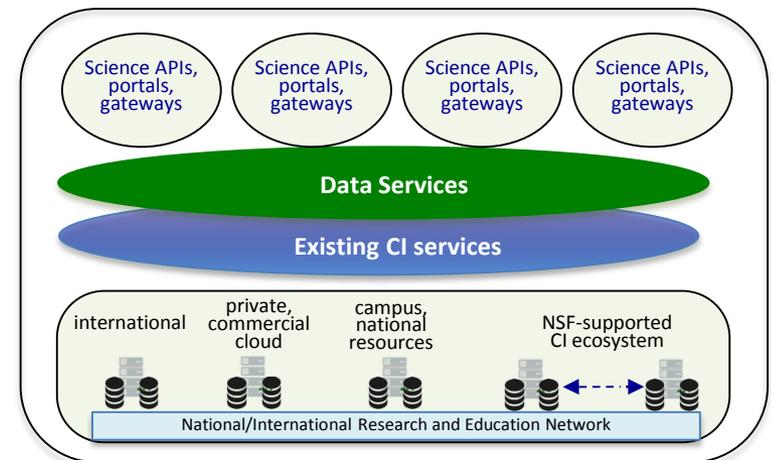
- Launched via Executive Order 13702, *Creating a National Strategic Computing Initiative* released July.
- NSF investments in NSCI aim to:
  - Increase coherence between technology used for modeling and simulation and that used for data analytics,
  - Establish a path forward for future HPC systems after reaching the current limits of semiconductor technology (in the “post Moore’s Law era”) e.g., through the Scalable **Parallelism in the Extreme (SPX) program**, and
  - Advance scientific discovery through the broader High-Performance Computing (HPC) ecosystem e.g., through **ACI-led programs**.
- NSF designated co-lead with DOD and DOE.



# Scalable Parallelism in the Extreme (SPX)

*Increasing computing performance in the modern era of parallel computing*

- Aligns with NSCI objectives.
- Aims to establish collaborations among researchers representing all areas from the application layer down to the micro-architecture.
  - Proposals required to have two or more PIs providing different and distinct expertise (with a collaboration plan).
- Research areas:
  - Algorithms
  - Programming Languages and Systems
  - Applications
  - Architecture and Systems
  - Extensible Distributed Systems
  - Performance Predictability

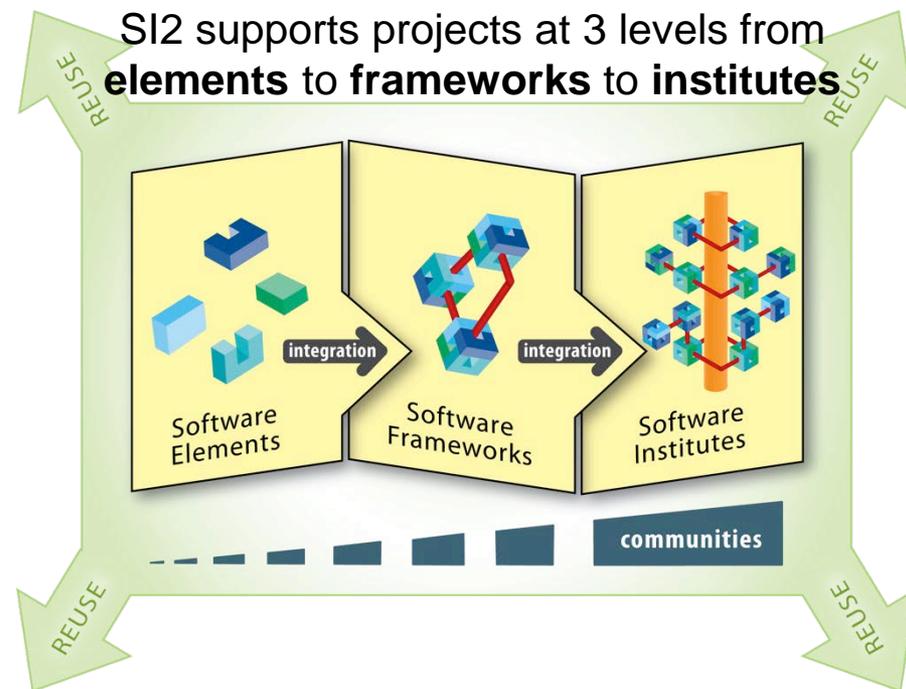


Proposals due: Jan 10, 2017

# Software Infrastructure for Sustained Innovation (SI2) Program

*Catalyzing reusable and sustainable software to advance discovery*

- Aligns with NSCI objective to augment the national HPC ecosystem.
- Supports the entire software lifecycle, resulting in sustainable community software elements and reusable components at all levels of the software stack.
- Addresses software in all aspects of cyberinfrastructure, from embedded sensor systems and instruments, to desktops and high-end data and computing systems, to major instruments and facilities.
- Current solicitation is focused on conceptualizing and implementing Scientific Software Innovation Institutes (S2I2).
- Cross-Directorate Solicitation: CISE, BIO, EHR, ENG, GEO, and MPS.



Proposals accepted anytime



# Smart & Connected Communities (S&CC)



- Aligns with the National Smart City Initiative launched Sept 2015.
- New solicitation posted Fall 2016.
- Builds on CISE leadership in areas e.g.,:
  - Cyber-Physical Systems (CPS)
  - Smart & Connected Health (SCH)
  - US Ignite: Networking Research and Application Prototypes Leading to Smart & Connected Communities
  - Dear Colleague Letter: CPS EAGERs Supporting Participation in the Global City Teams Challenge Communities (deadline Apr 1, 2016)
  - Dear Colleague Letter: Supporting Research Advances in Smart and Connected Communities (deadline Mar 1, 2016)



New

# Smart & Connected Communities (S&CC)

*Improving quality of life for all*

- Supports research and research capacity-building activities that integrate multiple disciplinary perspectives with meaningful community engagement to enhance smart and connected communities.
- Aims to enhance the understanding of and support for the design of smart and connected communities to improve the quality of life within them and to build research communities to address the challenges and opportunities of present and future smart and connected communities.
- Cross-Directorate Solicitation: CISE, EHR, ENG, GEO, and SBE.

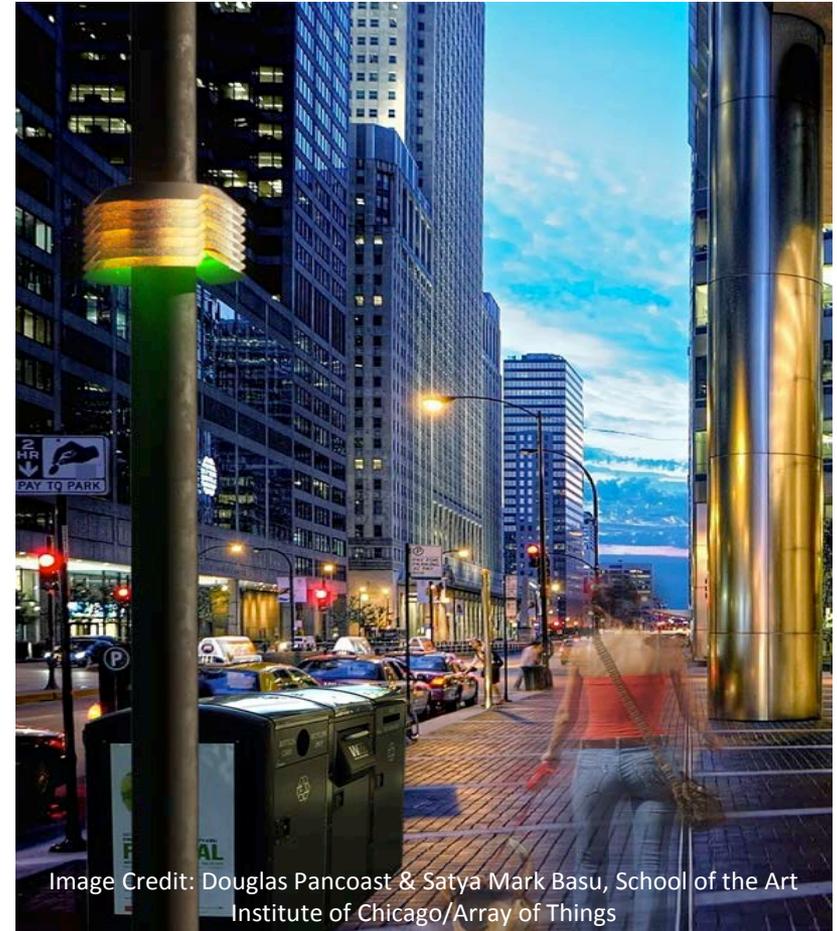


Image Credit: Douglas Pancoast & Satya Mark Basu, School of the Art Institute of Chicago/Array of Things

Preliminary proposals due: Nov 30, 2016

Full proposals due: Feb 16, 2017



# Cyber-Physical Systems (CPS)

*Deeply integrating computation, communication, and control into physical systems*

- Aligns with the National Advanced Manufacturing Partnership Initiative, and helped to build the foundation for the National Smart Cities Initiative.
- Aims to develop the core system science needed to engineer complex cyber-physical systems.
- Serves multiple application areas and key national priorities.
- Includes *Transition to Practice* option.
- Cross-Directorate and Cross-Agency Solicitation: NSF CISE and ENG with DHS, DOT, NASA, NIH, USDA.



Transportation



Energy and Industrial Automation



Healthcare and Biomedical



Critical Infrastructure

Proposals due: June 7, 2016



# Smart and Connected Health (SCH)

*Transforming healthcare knowledge, delivery, and quality of life through IT*

- Supports research to accelerate the development and use of innovative approaches to transform healthcare.
- Encourages breakthrough ideas in a variety of areas of value to health, such as sensor technology, networking, information and machine learning technology, decision support systems, modeling of behavioral and cognitive processes, as well as system and process modeling.
- Cross-Directorate and Cross-Agency Solicitation: NSF CISE, ENG, and SBE with NIH.



Integrative Proposals due: Dec 8, 2016

# US Ignite:

## Networking Research and Application Prototypes Leading to Smart & Connected Communities

- Aligns with the US Ignite Initiative and helped to build the foundation for the National Smart Cities Initiative.
- Aims to promote US leadership in the development and deployment of next-generation gigabit applications with the potential for significant societal impact.
- Two focus areas:
  1. **US Ignite Applications: Toward Smart & Connected Communities:** encourages the development of application ideas and prototypes that leverage or enhance advanced networking technologies (i.e., gigabit or greater throughput, software-defined networking, advanced wireless) and that address national priority areas.
  2. **Innovating Advanced Networks for Future US Ignite Applications:** supports fundamental research to advance networking technology and protocols that will further both the capabilities and our understanding of gigabit networking infrastructure to meet current and future application demands.
- Cross-Directorate and Cross-Agency Solicitation: NSF CISE and ENG with DOJ.

Proposals due: June 14, 2016



# Computer Science for All (CS for All)

- Launched during Presidential Weekly Address in January 2016, builds on investment and foundation laid by NSF over past 10 years.
- Aims to enable *all* students to have access to high-quality CS education in K-12.
- Led by NSF and Department of Education with participation from other federal agencies and private partners.
- NSF role: Build knowledge base and capacity for rigorous, engaging CS education and scalable and sustainable models of professional development for educators.
- CISE and EHR to provide \$120 million over five years through existing programs, e.g.,
  - STEM + Computing Partnerships (STEM+C)
  - Discovery Research PreK-12 (DRK-12)
  - Innovative Technology Experiences for Students and Teachers (ITEST)



*“In the new economy, computer science isn’t an optional skill – it’s a basic skill...”*

*President’s Weekly Address 1/30/2016*

[nsf.gov/csforall](http://nsf.gov/csforall)



# STEM + Computing Partnerships (STEM+C)

*Integrating computing into STEM*



- Supports research to integrate computer science into K-12 STEM education.
- Includes efforts e.g.,:
  - CS10K, including new AP<sup>®</sup> exam: CS Principles
  - Broadening Participation in Computing
- Cross-Directorate Solicitation: CISE and EHR.



Proposals due: March 14, 2017



# Advanced Wireless Research Initiative

- Launched in July 2016.
- Aims to sustain U.S. leadership in wireless communications and technology.
- More than \$400M investment over the next 7 years to:
  - Establish platforms for advanced wireless research enabled by a new industry consortium and engagement of public and private partners;
  - Support fundamental research enabling advanced wireless technologies; and
  - Catalyze academic, industry, and community leaders to work together to prototype innovative wireless approaches to address societal challenges.



# Platforms for Advanced Wireless Research (PAWR): Establishing the PAWR Project Office (PPO)

New

- Key component of the Advanced Wireless Research Initiative.
- First stage in the PAWR program aimed to establish a Project Office that will support the design, development, deployment, and initial operations of a set of research platforms.
- These platforms will enable at-scale experimentation on advanced wireless technology (e.g., robust new wireless devices, communication techniques, networks, systems, and services).
- Platforms will be supported by public and private partners:
  - \$50M NSF/CISE
  - > \$40M Industry Consortium of over 20 leading technology companies and associations



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The Wireless Association

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WIRELESS TECHNOLOGIES

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ADVANCING GLOBAL COMMUNICATIONS

Proposals due: Nov 23, 2016



New

# NSF/Intel Partnership on Information-Centric Networking in Wireless Edge Networks (ICN-WEN)

- Aligns with the Advanced Wireless Research Initiative.
- Part of an ongoing partnership with Intel Labs.
- Aims to support basic research on innovative network architectures that optimize wireless edge networks as a way to process very large quantities of information with improved response times.
- Proposals should address ultra low-latency applications and massive IoT deployments within three problem dimensions:
  1. Information-Centric Networking enabled Wireless Device Endpoints
  2. Information-Centric Networking Wireless Network Infrastructure and Architectures
  3. Security and Privacy
- Projects are strongly encouraged to make use of existing large-scale experimental network infrastructures, e.g.,
  - GENI, or Global Environment for Network Innovations (<http://www.geni.net>)
  - PlanetLab (<http://www.planet-lab.org>)

Letter of Intent (required) due: Sept 20, 2016  
Proposals due: Nov 21, 2016



# Additional CISE Funding Opportunities

- Algorithms in the Field (AitF)
- Expeditions-in-Computing
- NSF/Intel Partnership on Computer Assisted Programming for Heterogeneous Architectures (CAPA)
- NSF/VMware Partnership on Software Defined Infrastructure as a Foundation for Clean-Slate Computing Security (SDI-CSCS)
- Smart and Autonomous Systems (S&AS)
- Transdisciplinary Research in Principles of Data Science Phase I (TRIPODS)

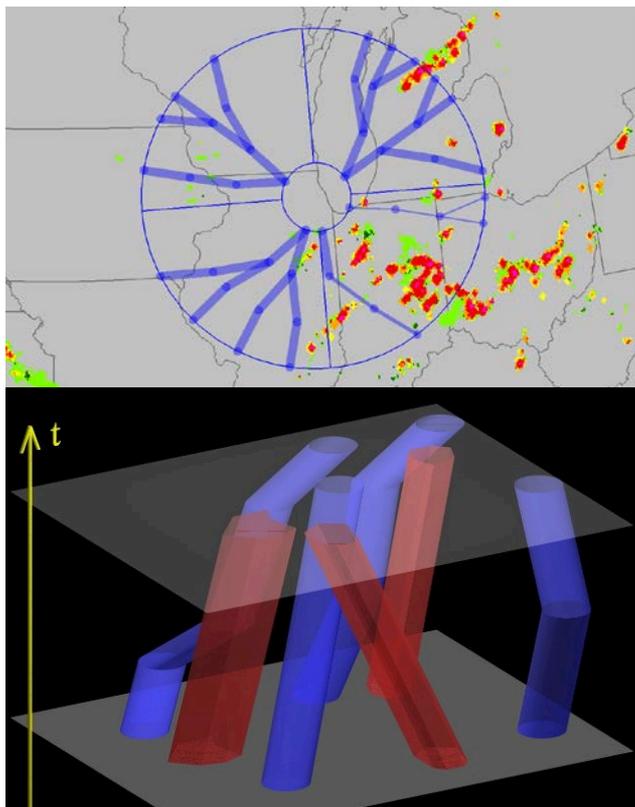
For a comprehensive list of CISE funding opportunities, visit:

[http://www.nsf.gov/funding/pgm\\_list.jsp?org=CISE](http://www.nsf.gov/funding/pgm_list.jsp?org=CISE)



# Algorithms in the Field (AitF)

*Advancing algorithmic design and the application area to which the algorithms are being deployed*



Images courtesy of Joseph Mitchell, SUNY at Stony Brook

- Encourages closer collaboration between theoretical computer science with domain experts and other CISE researchers.
- Aims to bridge the gap between theory, practice in design, analysis, implementation, and evaluation of algorithms.

Proposals due: Jan 12-26, 2017



# Expeditions-in-Computing

*Exploring scientific frontiers that promise transformative innovations in computing*

- Provides the CISE community an opportunity to pursue ambitious, fundamental research agendas that promise to define the future of computing and information.
- Successful projects bring together teams of investigators with diverse expertise within or across departments or institutions to identify compelling, transformative research agendas that seek disruptive innovations in CISE.

- **Funding:**  
up to \$2,000,000 per year  
for up to five years
- **Limit:**  
1 Expeditions proposal per individual
- **Deadlines:**  
Preliminary Proposal (required): May 2, 2016, Apr 25, 2018  
Full Proposal: Jan 18, 2017, Jan 16, 2019



New

# NSF/Intel Partnership on Computer Assisted Programming for Heterogeneous Architectures (CAPA)

- Aims to significantly improve software development productivity by partially or fully automating software development tasks.
- Proposals should address Programmer Effectiveness, Performance Portability, and Performance Predictability within the research areas:
  - Programming abstractions and methodologies
  - Program synthesis and learning
  - Hardware-based abstractions
  - Software engineering tools and practices
- An individual may participate as PI, co-PI, or senior personnel in no more than one proposal submitted in response to this solicitation.
- Intel Agreements contain provisions for possible direct, on-site participation in research by Intel researchers-in-residence.

Proposals due: Dec 8-15, 2016



# NSF/VMware Partnership on Software Defined Infrastructure as a Foundation for Clean-Slate Computing Security (SDI-CSCS)

New

*Enabling intelligent physical systems*

- Aims to explore software defined infrastructure (SDI) as an enabler of new approaches to security as well as a platform for research on security approaches.
- NSF and VMware will co-fund proposals and VMware will also contribute open-source SDI software and expertise to projects.
- An individual may participate as PI, co-PI, or senior personnel in no more than one proposal submitted in response to this solicitation.

Proposals due: Oct 5, 2016

# Smart and Autonomous Systems (S&AS)

*Enabling intelligent physical systems*

A starburst icon with the word "New" inside.

New

- Aims to enable long-term autonomous systems requiring minimal or no human operator intervention.
- Focuses on intelligent physical systems (IPS) that are cognizant, taskable, reflective, ethical, and knowledge-rich.

Proposals due: Dec 19, 2016



# Transdisciplinary Research in Principles of Data Science Phase I (TRIPODS)

A starburst icon with the word "New" inside.

New

*Enabling intelligent physical systems*

- Aims to bring together statistics, mathematics, and theoretical computer science communities to develop the theoretical foundations of data science through integrated research and training activities.
- Phase I will support the development of small collaborative Institutes.
- Phase II (to be described in an anticipated future solicitation, subject to availability of funds) will support a smaller number of larger Institutes, selected from the Phase I Institutes via a second competitive proposal process.
- All projects must involve significant and integral participation by all three communities.
- Cross-Directorate Solicitation: CISE and MPS.

Proposals due: Dec 19, 2016



# CISE is committed to supporting early-career faculty



Credit: NSF

## Faculty Early Career Development (CAREER) Program

*Integrating research and education efforts*

*One of NSF's most prestigious awards for faculty beginning their independent careers who exemplify the role of teacher-scholars.*

## CISE Research Initiation Initiative (CRII)

*Jumpstarting research independence*

*Open to faculty in first two years of an independent academic position to recruit and mentor undergraduate and graduate students, enabling a subsequent stream of discoveries and innovations. First awards in FY15.*



Credit: XieYu Lin



Credit: NeTS Early Career Workshop

## Proposal Writing Workshops, Aspiring PI Meetings, and Early-career Workshops

*Strengthening research and education activities through community*

*Introduces early-career faculty to NSF, merit review process, and peers and senior researchers in their field.*



# Computing Research Initiation Initiative (CRII)

*Enabling early research independence*

- Aims to contribute to the growth and development of future generations of scientists and engineers who will dedicate their careers to advancing CISE research and education.
- Provides the opportunity for individuals who are in their first academic position post-PhD to recruit and mentor their first graduate students.
  - Allows for a full budget for grad student salary only (and some travel, equipment) but no PI salary.

Proposals due: Aug 10, 2016



# Faculty Early Career Development (CAREER) Program

- The National Science Foundation's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through:
  - outstanding research,
  - excellent education, and
  - the integration of education and research within the context of the mission of their organizations.
- Since its inception in 1996:
  - More than 200 programs have reviewed CAREER proposals.
  - More than 7,000 awards.
- PIs are allowed only one submission per competition.

## ***CISE CAREER Proposal Writing Workshops***

- Generally held in Spring each year
- For more information see:  
<http://www.nsf.gov/cise/workshops/career>
- Presentations from past workshop  
at: [http://carch.seas.gwu.edu/cise-career/NSF\\_2016.html](http://carch.seas.gwu.edu/cise-career/NSF_2016.html)

Proposals due: July 20, 2016  
(other Directorates may have  
different deadlines)



# Support for Graduate and Undergraduate Students

- ***Graduate Research Fellowship Program (GRF)***
  - Foundation-wide programs with substantial CISE participation.
  - Deadlines in mid-Nov but differ for each Directorate.
- ***Research Experiences for Undergraduates (REU)***
  - **REU Sites**
    - Typically in summer.
    - 8-10 students in a cohort environment.
    - Deadline in August.
  - **REU Supplements**
    - Support for 1-2 students to work on existing project.
    - Best to submit request by March but no strict deadline.



# Other NSF-wide Opportunities for the CISE Community

- Innovation Corps (I-Corps)
- Grants for Rapid Response Research (RAPID)
- EARly-concept Grants for Exploratory Research (EAGER)
- Conferences, Summer Schools, and Workshops
- International Collaborations

For a comprehensive list of NSF funding opportunities, visit:

<http://www.nsf.gov/funding/>



# Innovation Corps (I-Corps)

*Accelerating innovations from the laboratory to the market*

- Aims to develop and nurture a national innovation ecosystem that builds upon fundamental research to guide the output of scientific discoveries to the development of technologies, products and processes that benefit society.
- NSF-funded researchers are eligible to receive additional support in the form of mentoring and funding through I-Corps.
- **Must consult with a program director before submission.**

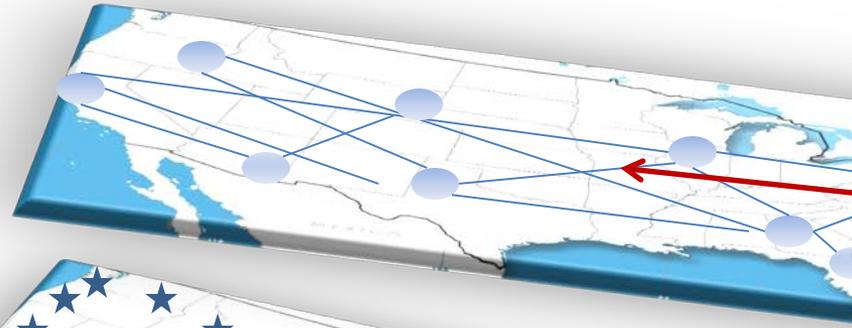


NSF-wide Initiative



# Building the Nation's I-Corps "Fabric"

**I-Corps Nodes**  
(NSF Program)



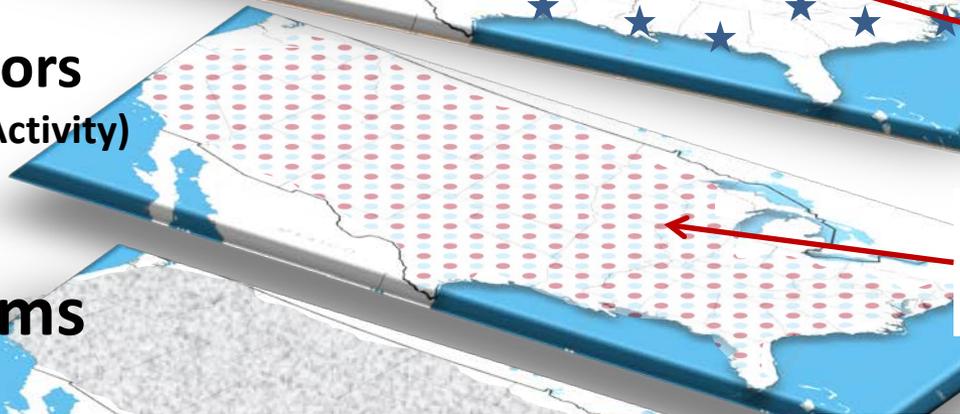
National Network of university collaborators – offer immersion curriculum and engage in research about commercialization

**I-Corps Sites**  
(NSF Program)



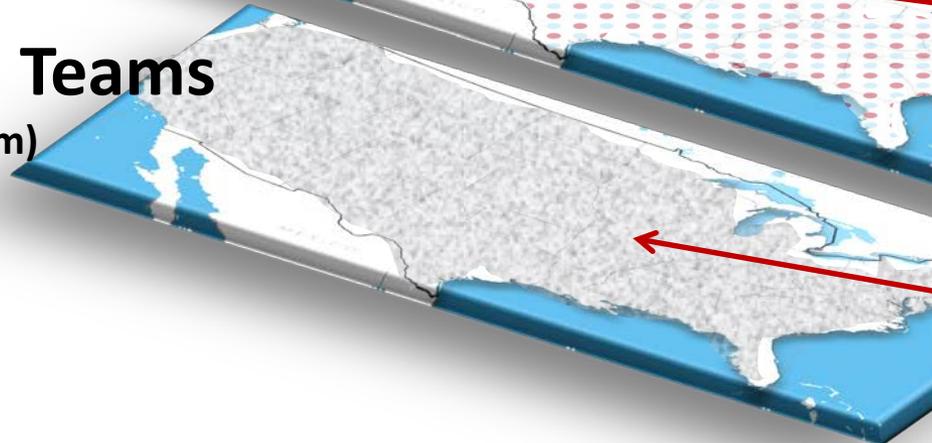
National network of universities that can enable their local teams

**I-Corps Mentors**  
(External Partners Activity)



National network of serial-entrepreneurs who Mentor I-Corps Teams

**I-Corps Teams**  
(NSF Program)



National network of "Grass-Roots" activities by NSF PIs – individual teams pursue I-Corps Curriculum and commercialization



# RAPID and EAGER Proposals

- ***Grants for Rapid Response Research (RAPID):***
  - Supports quick-response research on natural or anthropogenic disasters and similar unanticipated events.
  - Up to \$200K and one year duration.
  - Project descriptions are expected to be brief (two to five pages) and include clear statements as to why the proposed research is of an urgent nature.
- ***EARLY-concept Grants for Exploratory Research (EAGER):***
  - Supports high-risk, exploratory and potentially transformative research.
  - Up to \$300K and two years duration.
  - Project description is expected to be brief (five to eight pages) and include clear statements as to why this project is appropriate for EAGER funding.



# Conferences, Summer Schools, and Workshops

- ***Conferences***
  - Student Travel Support
  - Doctoral Consortia
- ***Summer Schools***
  - Intensive program for doctoral students on emerging research topics.
  - Require faculty expertise not available at any single institution.
- ***Workshops***
  - Bring the community together to reflect on, and identify emerging research opportunities and challenges.

**Must consult with a program director before submission.**



# International Collaborations

- ***Supplements*** to existing projects to allow US researchers to engage in collaborative activities with international partners:
  - True intellectual collaboration with foreign research partner;
  - New international collaborations;
  - Clear benefit to U.S. science/engineering community from expertise, facilities, or resources of the foreign collaborator; and
  - Active research engagement of U.S. students and junior researchers at the foreign site.
- ***East Asia and Pacific Summer Institutes for U.S. Graduate Students (EAPSI)***
- ***International Research Fellowship Program (IRFP)***
- If what you have in mind does not fit one of the existing programs, get in touch with the PD responsible for the country, or region of interest in the NSF Office of International Science and Engineering.



# Commitment to Research and Education in CISE

- As a field of inquiry, computer, communication and information science and engineering has a **rich intellectual agenda** – highly creative, highly interactive, with enormous possibilities for changing the world!
- A thriving basic research community is the foundation for long-term **discovery** and **innovation**, **economic prosperity**, and **national security**.
- Our investments in **research and education** have returned exceptional dividends to our nation.



# Stay Informed

- Subscribe to get NSF updates by email at [www.nsf.gov](http://www.nsf.gov).
- Subscribe to receive special CISE announcements:
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- Visit the CISE website often: <http://www.nsf.gov/dir/index.jsp?org=CISE>.
- Talk to Program Directors: [http://www.nsf.gov/staff/staff\\_list.jsp?org=CISE&from\\_org=CISE](http://www.nsf.gov/staff/staff_list.jsp?org=CISE&from_org=CISE).
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# Acronyms

## NSF Directorates:

- BIO: Biological Sciences
- CISE: Computer & Information Science & Engineering
- EHR: Education & Human Resources
- ENG: Engineering
- GEO: Geosciences
- MPS: Mathematical & Physical Sciences
- SBE: Social, Behavioral & Economic Sciences

## Other acronyms:

CS: Computer Science

SRC: Semiconductor Research Corporation



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