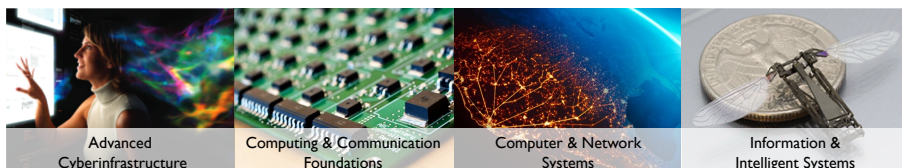


Welcome (and overview of NSF CISE)



Jim Kurose
Assistant Director, NSF
Computer & Information Science & Engineering
(CRA Career Mentoring Workshop Co-Chair, 2014)
2018 Career Mentoring Working

February 2018



You (early career researchers)
are here because **we** (NSF, CISE, CRA, CS community)
care about you – our future!

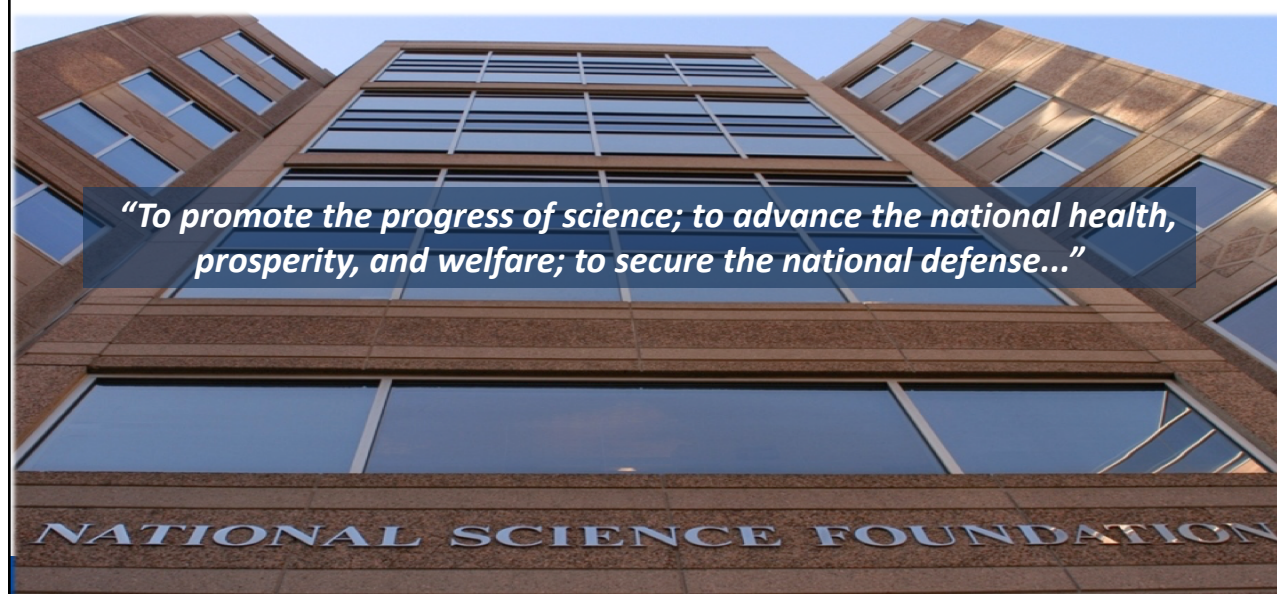
Thank you for being here!



National Science Foundation's Mission



National Science Foundation's Mission



Our new home



**Come
visit!**



CISE programs address national priorities



Big Data & AI



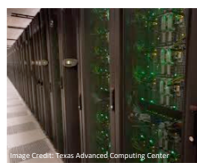
Cybersecurity



**Robotics &
Manufacturing**



**Understanding the
Brain**



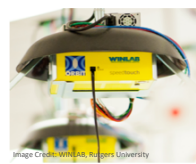
**Advanced
Cyberinfrastructure**



**Smart
Communities**



**Computer Science
Education**



**Advanced Wireless
Research**



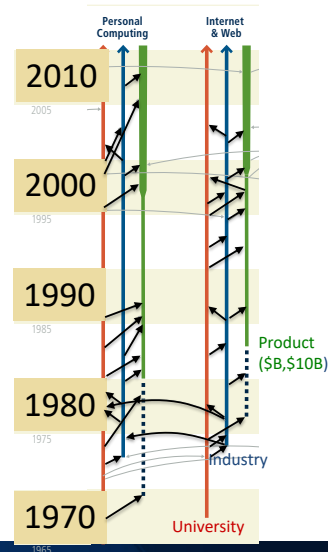
Economic impact of CISE: From Federally-funded research to billion-dollar industries

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

- drive U.S. competitiveness
 - IT accounts for 25% of economic growth since 1995;
 - resulted in many billion-dollar industries: networking, software, digital communications, computer graphics, AI and robotics, and more
- have profound impacts on our daily lives.

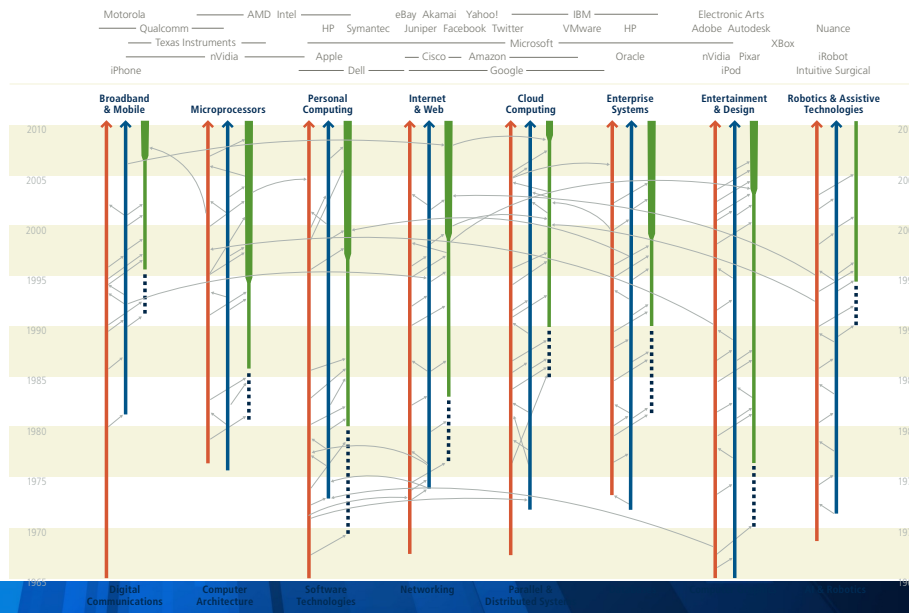


Source: National Research Council. 2012. *Continuing Innovation in Information Technology*.



7

.... across many industries



8

This impact continues today

Machine Learning

- Big Data Analytics Market: \$125B (Forbes)
- Deep learning rooted in NSF-funded research on neural networks, reinforcement learning



"NSF is where all interesting research gets started..." - Eric Schmidt, Google / Alphabet

Software-Defined Networking (SDN)

- SDN Market: \$18B in 2018 (IDC)
- SDN resulted from NSF-funded foundational research



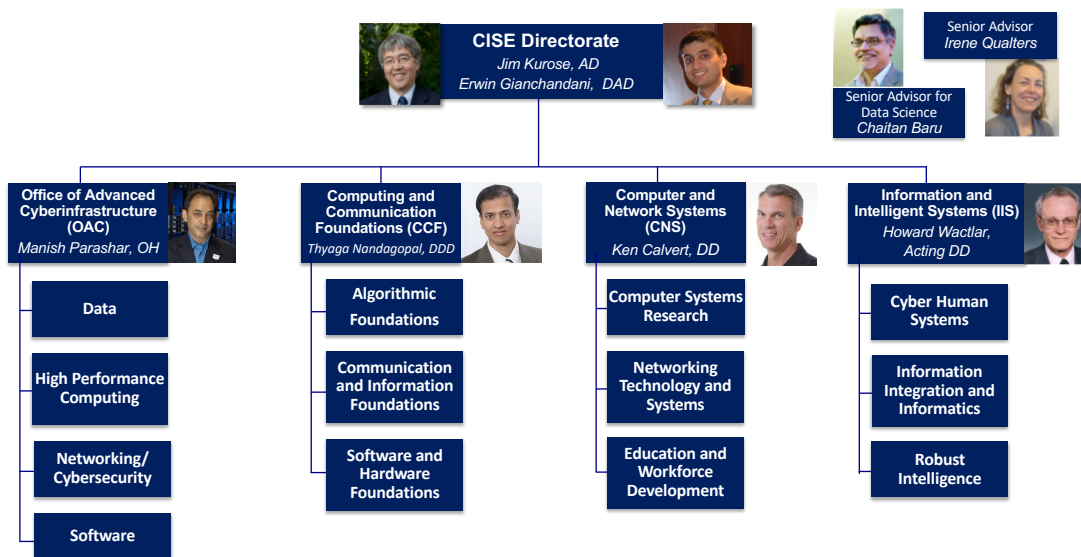
Open Programmable Mobile Internet 2020 project funded by NSF/CISE Expeditions program, 2008, N. McKeown, Stanford U.



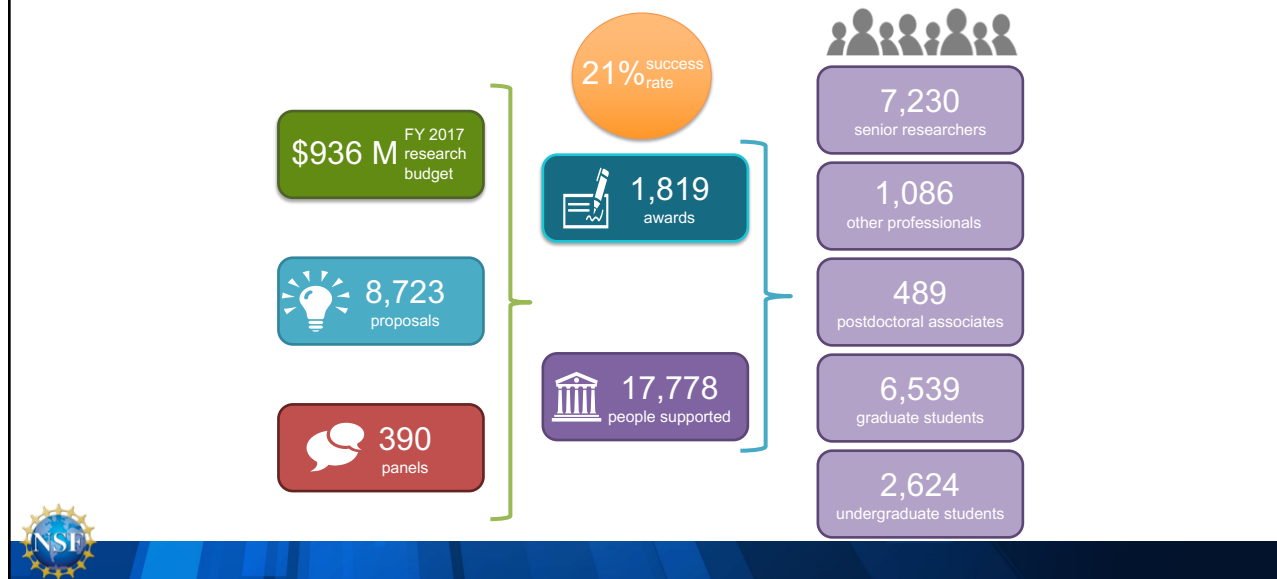
Fundamental research powers innovation

9

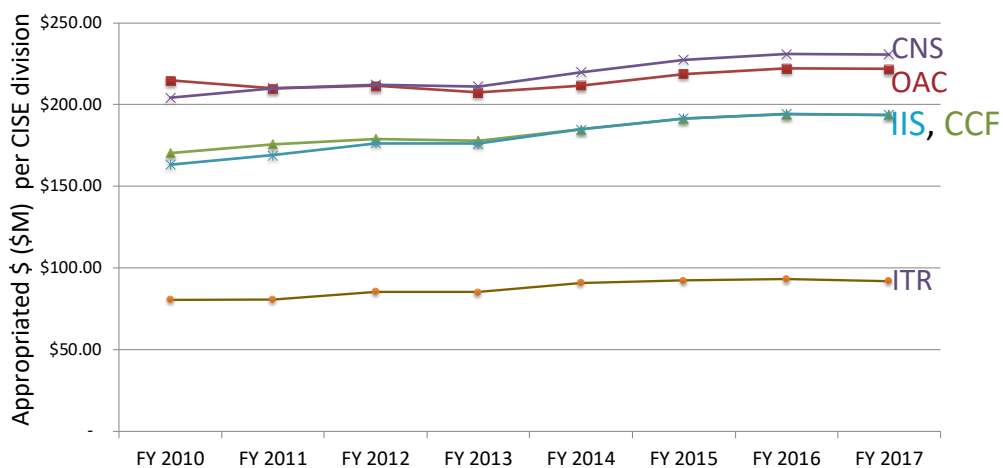
CISE Organization



CISE by the Numbers: FY 2017

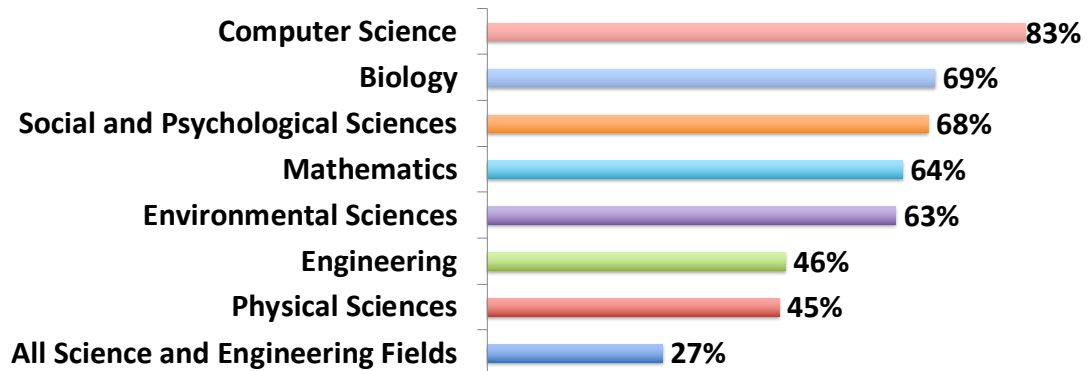


NSF/CISE Division Budgets



NSF Supports All Areas of Fundamental Research

NSF support as a percentage of total federal support for basic academic research



Source: NSF/NCSES, "Survey of Federal Funds for Research and Development"



CISE Research Investments

- 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



Computing and Communication Foundations (CCF)

Algorithmic Foundations

Communication and Information Foundations

Software and Hardware Foundations



Computer and Network Systems (CNS)

Computer Systems Research

Networking Technology and Systems

Education and Workforce Development



Information and Intelligent Systems (IIS)

Cyber Human Systems

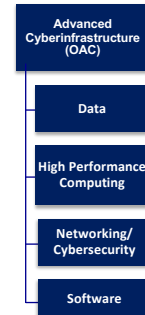
Information Integration and Informatics

Robust Intelligence

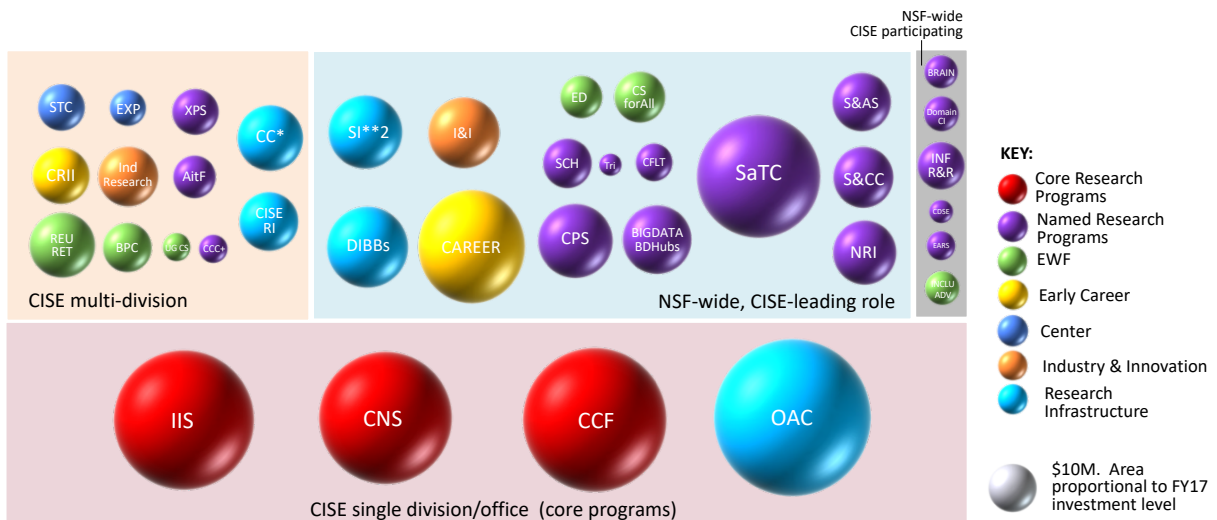


CISE Research Infrastructure Investments

- Lead support for expansive CI ecosystem driven by research priorities and the scientific process
- Leverage investments by universities, federal agencies, commercial sector
- Support unique human and technical resources to meet the expanding and diverse needs at the forefront of science and engineering
- Align with the National Strategic Computing Initiative (NSCI)



CISE Programmatic Overview



Opportunity: Tremendous federal interest in CISE



August 2017

TO: THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES
 FROM: MICK MULVANEY
 DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET
 MICHAEL KRATSIOS
 DEPUTY ASSISTANT TO THE PRESIDENT
 OFFICE OF SCIENCE AND TECHNOLOGY POLICY
 SUBJECT: FY 2019 Administration Research and Development Budget Priorities

FY 2019 R&D Budget Priorities memo:

"autonomous systems, ... machine learning, and quantum computing coordinated interagency initiatives, ... STEM education, including computer science education "



"prioritize emerging technologies critical to economic growth and security, such as data science, encryption, autonomous technologies,... advanced computing technologies, and artificial intelligence. "



House Oversight: Game Changers: AI (Feb., March 2018)

HSST: Science Infrastructure (March 2017)



HSST: CS Education Roundtable (Sept. 2017)



HSST: American Leadership in Quantum Technology (Oct. 2017)

An *amazing* time to be in CISE!

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!*





You (early career researchers)
are here because **we** (NSF, CISE, CRA, CS community)
care about you – our future!

Thank you for being here!



THANKS!



CRA leadership, staff, and Board!



NSF Big Ideas

RESEARCH IDEAS

<p>HARNESSING THE DATA REVOLUTION</p> <p>Harnessing Data for 21st Century Science and Engineering</p>	<p>Work at the Human-Technology Frontier: Shaping the Future</p>	<p>Windows on the Universe: Multi-messenger Astrophysics</p>	<p>Quantum Leap: Leading the Next Quantum Revolution</p>
<p>Navigating the New Arctic</p>	<p>Understanding the Rules of Life: Predicting Phenotype</p>		

PROCESS IDEAS

<p>Mid-scale Research Infrastructure</p>	<p>NSF 2026</p>
<p>Growing Convergence Research at NSF</p>	<p>NSF INCLUDES: Enhancing STEM through Diversity and Inclusion</p>



“ ... bold questions that will drive NSF's long-term research agenda -- questions that will ensure future generations continue to reap the benefits of fundamental S&E research. ”



“AI is the universal connector that interweaves all of our Big Ideas; data science is changing the very nature of scientific inquiry, and AI's use of data has the potential to revolutionize everything we do in science.”

F. Cordova, Director, NSF, 9/11/17

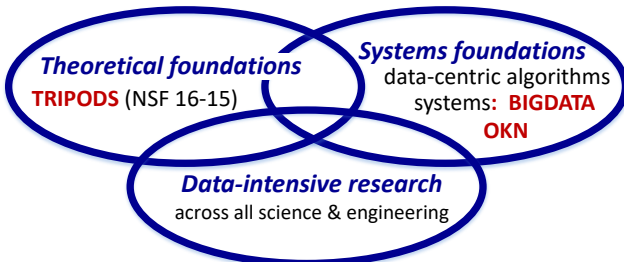


*“engage NSF's research community in the pursuit of **fundamental research in data science and engineering**, the development of a cohesive, federated, national-scale approach to **research data infrastructure**, and the development of a **21st-century data-capable workforce**.”*



Harnessing the Data Revolution (HDR)

Research across all NSF Directorates



Educational pathways



Innovations grounded in an education-research-based framework
NASEM study: data science, the undergraduate perspective, NSF Research Traineeships, NSF Graduate Research Fellowships



Advanced cyberinfrastructure
Accelerating data-intensive research.
Midscale infrastructure (Midscale RFI)



The Future of Work at the Human-Technology Frontier

"a unique opportunity to actively shape the development and use of technologies to improve the quality of work while also increasing productivity and economic growth"

Research Themes

- Building the human-technology partnership
- Augmenting human performance
- Illuminating the socio-technological landscape
- Fostering lifelong learning



Quantum Leap: Leading the Quantum Revolution

- **Fundamentals** that advance our understanding of uniquely quantum phenomena and their interface with classical systems
- **Elements** that measure, model, control, and exploit quantum particles
- **Software systems and algorithms** that enable quantum information processing
- **Workforce**, including training a new generation of scientists, engineers



Partnerships: Many dimensions

Partnerships build capacity, leverage resources, increase the speed of translation from discovery to innovation



Prescription 3:
Establishing a More Robust National Government-University-Industry Research Partnership



- **Joint NSF/industry research solicitations:** Intel (5), SRC (8), VMware (2)
- **Research infrastructure: PAWR:** Platforms for Advanced Wireless Research, cloud credits for BIGDATA (AWS, Google, Microsoft), **CISE Cloud workshop** (Jan. 2018)
- **Individual project-based:** I/UCRC, InTrans, GOALI

Joint investments between CISE and industry: FY 2014-FY 2018

Partner	No. joint solicitations	NSF investment	Partner investment
Semiconductor Research Corporation (SRC)	8	\$37 million	\$18 million
Intel Labs	5	\$13.5 million	\$13.5 million
VMware, Inc.	2	\$8 million	\$4 million
PAWR Industry Consortium (>25 companies)	1	\$50 million	\$50 million
Cloud credits via Amazon, Google, and Microsoft	2	\$48 million	\$12 million
Totals	17	\$156.5 million	\$97.5 million



NSF Takes Steps to Combat Sexual Harassment in Science: Important Notice, February 8, 2018



Basic research is done in all environments all over the world. All of those places must be harassment free.

New measures to combat sexual harassment at grantee institutions:

- new award requirements
- harassment-free research workplaces
- enhanced Web resources: [nsf.gov/harassment](https://www.nsf.gov/harassment)

Find more here:

<https://www.nsf.gov/od/odi/harassment.jsp>

