

# Introduction to NCSA

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**I** ILLINOIS

NCSA | National Center for  
Supercomputing Applications

# NCSA Strategic Plan

- NCSA Mission:

NCSA leads and supports partnerships around campus, the nation, and the world by developing our staff and leveraging their expertise, experience, and innovation in digitally-enabled scholarship to solve the most scientifically and societally important and challenging problems.

->Research focus areas: Artificial Intelligence, Arts and Humanities, Astrophysics, Digital Agriculture, Earth and Environment, Engineering, Health Sciences, ...



# National Center for Supercomputing Applications



- Interdisciplinary institute at Illinois reporting to Office of the Vice Chancellor for Research and Innovation
  - One of original five NSF supercomputing centers: Engage the nation's scientists and engineers on advanced research applications leveraging state-of-the-art computing capabilities (software, hardware, HPC expertise)
- In total, > \$1 Billion brought to U. Illinois since 1985
  - Approximately 240 staff (160+ technical/professional staff, academic professionals, and postdocs), two facilities
- Coordinating and providing key elements of NSF's national cyberinfrastructure: Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support (ACCESS)

**VICE CHANCELLOR FOR RESEARCH & INNOVATION  
SUSAN MARTINIS**

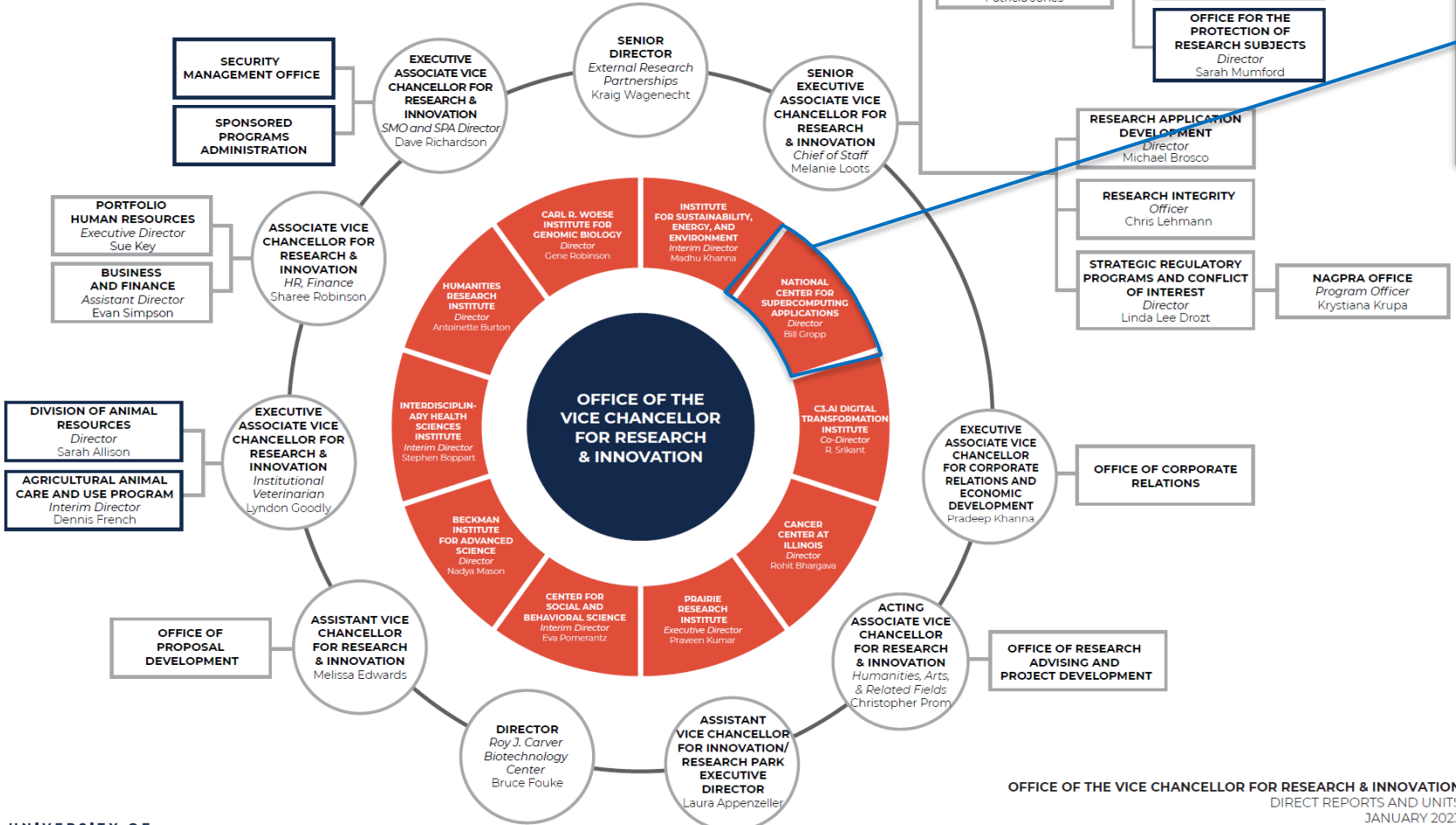
**ADMINISTRATIVE ASSISTANT**  
Tammy Nohren

**ASSISTANT VICE CHANCELLOR FOR RESEARCH & INNOVATION**  
*Compliance*  
Patricia Jones

- Division of Research Safety**  
*Director*  
Stephanie Hess
- INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE**  
*Chair*  
Ryan Dilger
- OFFICE FOR THE PROTECTION OF RESEARCH SUBJECTS**  
*Director*  
Sarah Mumford



**Bill Gropp,  
Director  
of NCSA**



**OFFICE OF THE VICE CHANCELLOR FOR RESEARCH & INNOVATION**  
DIRECT REPORTS AND UNITS  
JANUARY 2023

- Research Institutes
- VCRI Administration
- Compliance and Research Support Units





# NCSA Leadership



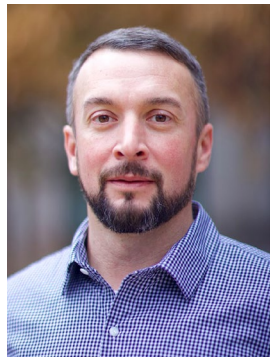
**Bill Gropp**  
NCSA Director



**Dan Katz**  
*Chief Scientist*



**Jay Roloff,**  
*Interim Chief of Staff*



**Theo Long,**  
*Associate Director,*  
*Administration*



**Laura Herriott**  
*Associate Director,*  
*Research Consulting*



**Kenton McHenry**  
*Associate Director,*  
*Software*



**Tim Boerner**  
*Interim Associate*  
*Director, Integrated*  
*Cyberinfrastructure*



**John Towns**  
*Executive*  
*Associate Director,*  
*Engagement*

**Director's Office**  
*Bill Gropp*



**NCSA Executive Committee**



**Engagement**

- Research & Education (R&E)
- Astrophysical Surveys Program Office (ASPO)
- Center for Digital Ag (CDA)
- Center for AI Innovation (CAII)
- Industry Program
- Healthcare Innovations Program Office (HIPO)
- Center for Exascale-Enabled Scramjet Design (CEESD)
- Blue Waters Program Office/NFI
- ACCESS
- Midwest Big Data Hub Project Office (MBDH)
- Delta Project Office
- Visualization Program Office
- Innovative Systems Lab

**Research Consulting**

- Science & Engineering Applications Support (SEAS)
- Technology Management Group (TMG)
- Business IT
- Modeling & Simulation
- Data Analytics
- Genomics
- Research Facilitation Services

**Integrated Cyberinfrastructure**

- Cybersecurity (CSD)
- Continuous Improvement & Innovation (CIID)
- Advanced Systems (ASD)
- Data Management & Delivery (DMDD)

**Software**

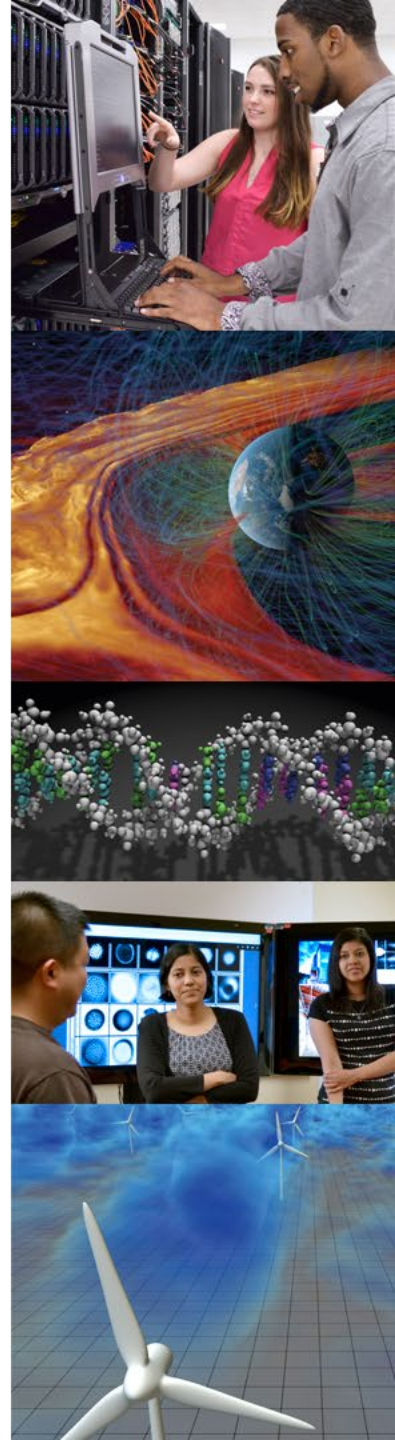
- Software Applications and Data Lab (SADL)
- Research Software Applications and Learning Technologies (ReSALT)
- Middleware Technology Group (MTG)
- Software Design Delivery and Deploy (SD3)
- Visual Analytics (VA)
- Tools for Research Institutions and Infrastructure (TRI)

**Administration**

- Facilities
- Business Office
- Human Resources (HR)
- Project Management Coordination Office (PCO)
- Administrative Support Coordination Office (ACO)
- Communications (Comm)

# NCSA is Focused on Applications

- Long history of focus on applications
  - Mosaic, first successful graphical web browser
  - Early adopter of GPU technologies (PS2 cluster, EcoG, GPUs in Blue Waters, now Delta, the most powerful GPU resource for the National Science Foundation)
- Recent examples include
  - NCSA developed, from scratch, the Laboratory Information Management System used by SHIELD T3, CU, and ILLINOIS for managing the University's innovative saliva-based COVID-19 PCR test.
  - SimBioSys used Blue Waters GPUs to calibrate the TumorScope prediction engine, used to predict optimal cancer therapy
  - NCSA has developed *Clowder*, a customizable and scalable data management framework to support any data format and multiple research domains. Created with significant funding from NSF.

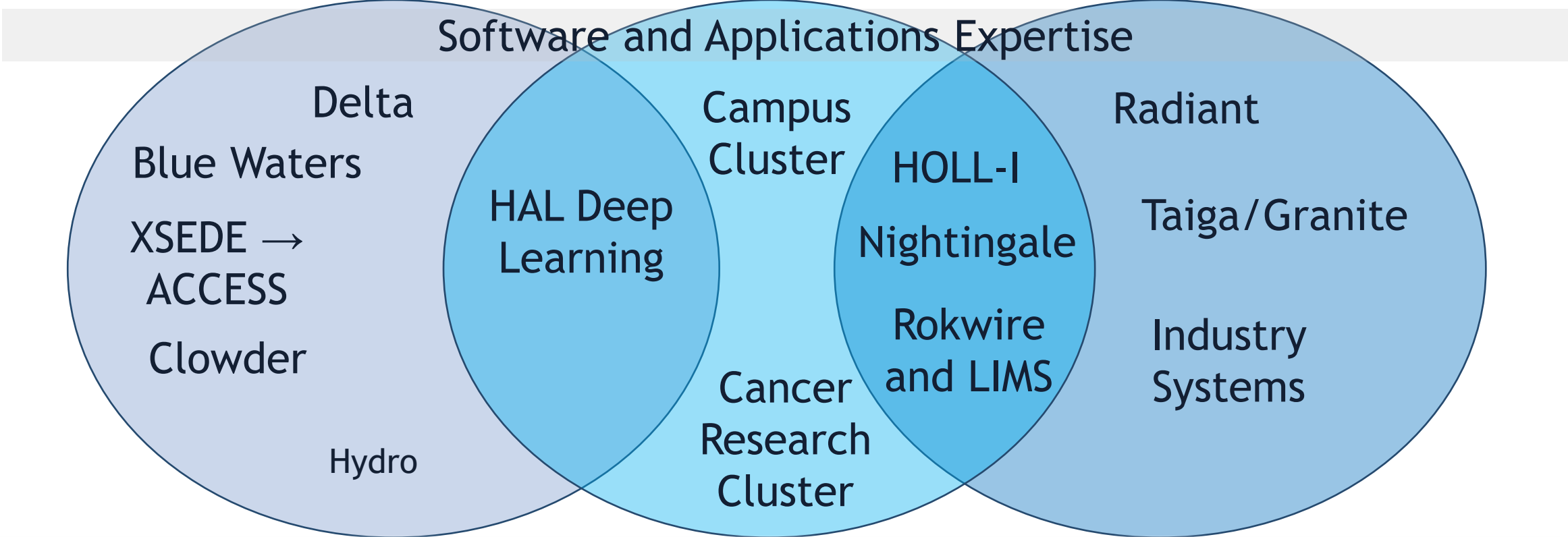


# NCSA's Strategy for Cyberinfrastructure

Federal Grants

Collaborations

Fee For Service



Common Storage Infrastructure (Center-wide File System)

This does not include external providers - e.g., other national resources (Illinois researchers are major users) or commercial clouds (especially for our Industry program)



# NCSA offers access to a variety of computing resources from campus level to the Nation

- **Campus Cluster:** 4 nodes dedicated to NCSA Faculty Fellows + access to NCSA allocation queue; *nodes dedicated to campus researchers coming soon!*
- **HAL Cluster** for Deep Learning research on campus
- **HOLL-I** for extreme scale machine learning
- **Radiant** private cloud computing service
- **Nightingale** high-performance compute cluster for sensitive data
- **Delta:** new advanced computing and data resource system to expand GPU-based computing.
- **ACCESS: Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support**
  - access to various machines and services (storage, software, etc.) via separate application process
  - training



# What is NCSA's Engagement Directorate?

- Mission

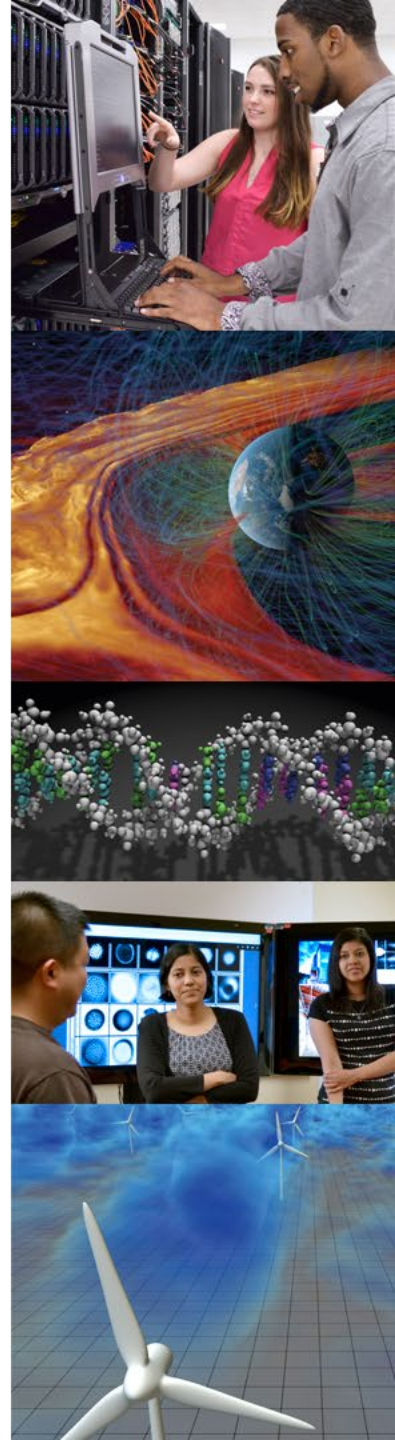
*Engagement fosters and supports NCSA's collaborative efforts to create and pursue research, development, and service opportunities and to support the execution of programs and projects.*

- Key Objectives

- develop opportunities for NCSA to engage in collaborative research, development, and service activities
- support the pursuit of opportunities via proposals, contracts, and other vehicles
- provide mentorship opportunities to develop new PIs

# Additional Responsibilities

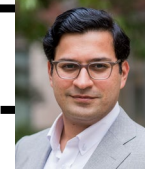
- UIUC Faculty Fellows/Affiliates Development
- Visiting Scholars program
- UIUC Student Fellows Development
- Student Programs
- UIUC New Community Development
- Proposal Development Office
- Consortiums
- Education/Outreach



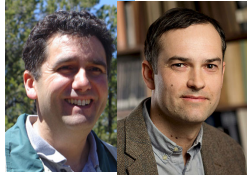
# NCSA Engagement

## Engagement EAD Office

- John Towns (EAD)
- TBD (Deputy AD)
- Yousaf Shah (PM)



## Engagement Leads



### Research & Education (R&E)

- Center Affiliates
- Student Programs
- Research Teams

### Astrophysical Surveys Program Office (ASPO)

- CAPS
- Rubin Observatory (LSST)
- DES

### Center for Digital Ag (CDA)

- AIFARMS
- Farm of the Future
- CROPPS

### Center for AI Innovation (CAII)

### Industry Program

### Healthcare Innovations Program Office (HIPO)

### Innovative Systems Lab

### Center for Exascale-Enabled Scramjet Design (CEESD)

### Delta Project Office

and  
Blue Waters Project Office

- Blue Waters
- NFI

### XSEDE Project Office

### Midwest Big Data Hub Project Office (MBDH)

### Visualization Program Office

- AVL



# NCSA Research & Education

- R&E Mission:
  - Develop deeper and integrative connections to the Illinois campus with faculty, postdocs, and students
- Research and Education is within the Engagement Directorate
- R&E Major Functions:
  - Connect to the primary research and education mission of the university by driving innovation at NCSA and helping Illinois respond actively to the challenges of 21<sup>st</sup> century transdisciplinary research and education
  - Help to advance the technologies, labs and projects in NCSA
  - Pursue external funding opportunities through NCSA



# NCSA Education

- 184 faculty and center affiliates
- Post-Doctoral Research Program
- Undergraduate and graduate students
  - SPIN program: NCSA undergraduates internship program
    - SPIN students are eligible for Fiddler Fellowship Awards
  - NSF-funded REU FoDOMMaT (The Future of Discovery: Training Students to Build and Apply Open-Source Machine Learning Models and Tools)
  - NSF-funded Cyberinfrastructure Professional Intern Program (CIP)
  - NCSA International Research Internship Program



# Research Consulting at NCSA

*ENABLING AND CONDUCTING ACADEMIC & INDUSTRY RESEARCH*

## User Support

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- Help desk
  - Access, sys. monitoring
- Business IT
  - Desktop Support, Event Services, CMDB, Savannah, Tableau, Conference Room and Virtual Meeting Support
- Computing environments
  - Compilers, libraries, I/O
  - Allocations
- Jobs
  - Scripts, queues, web interfaces

## Research Solutions

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- Code dev. & improvements
  - Debugging, profiling, development
- Software & apps
  - Installs, maintenance, validations, benchmarks
- Advanced support
  - Numerical methods, accelerated computing, advanced programming
- Domain expertise and consulting
  - Modeling/Simulation, Genomics, Data Analytics, Machine Learning, GIS, Physics, Engineering, Astronomy

## Outreach

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- Academic and industry collaboration and partnership
- Grant development
- Student talent & workforce development

# Illinois Computes

- \$50M total investment over 5 years
  - Urbana campus investment \$30M
  - Illinois system investment \$20M
- Essentially 50/50 split between hardware and consulting support
- Campus and System advisory board governance
- In addition to our campus cluster program and Research IT efforts



UNIVERSITY OF  
**ILLINOIS**  
URBANA - CHAMPAIGN

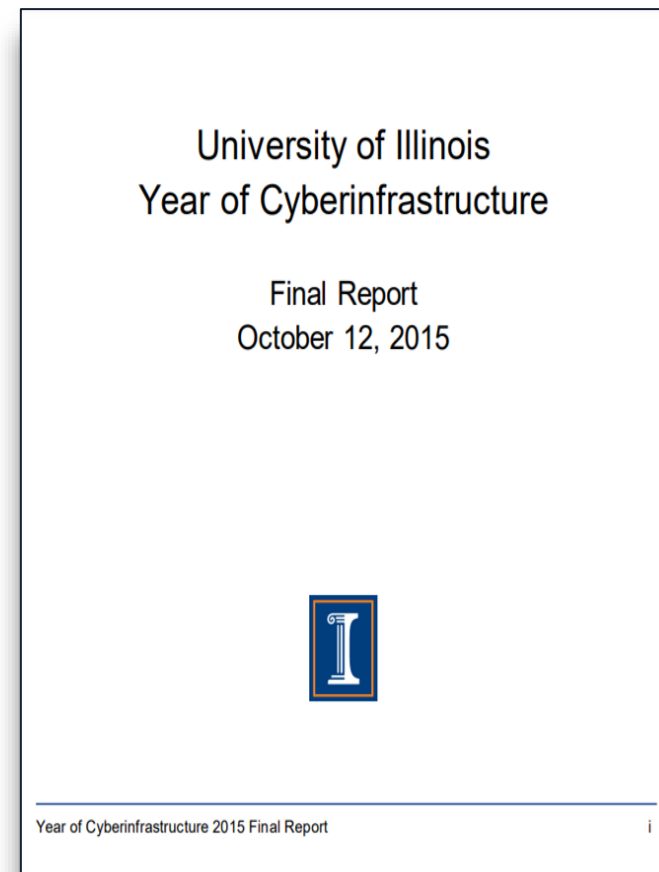


UNIVERSITY  
OF ILLINOIS  
SYSTEM



# Before Illinois Computes

- 2015 Year of Cyberinfrastructure:  
<https://www.ideals.illinois.edu/items/89757>
- Three proposals to campus between 2016 and 2022
- Summer 2022 signed MOU for Illinois Computes



# Illinois Computes: Goals

- Provide a baseline of **computing & support** to all researchers
- Enable any researcher to start using computing and data resources **without needing to find funding first**
- **Broaden access and use** of computing and data in research
- Engage with users to **understand their needs and wants** to ensure a customer-driven approach and **innovate** to stay forward-looking as technology advances
- **Complement other efforts** and infrastructure on campus and nationally including Research IT, Illinois Campus Cluster Program, efforts at the college, institute, and unit level, and Delta via an ACCESS allocation

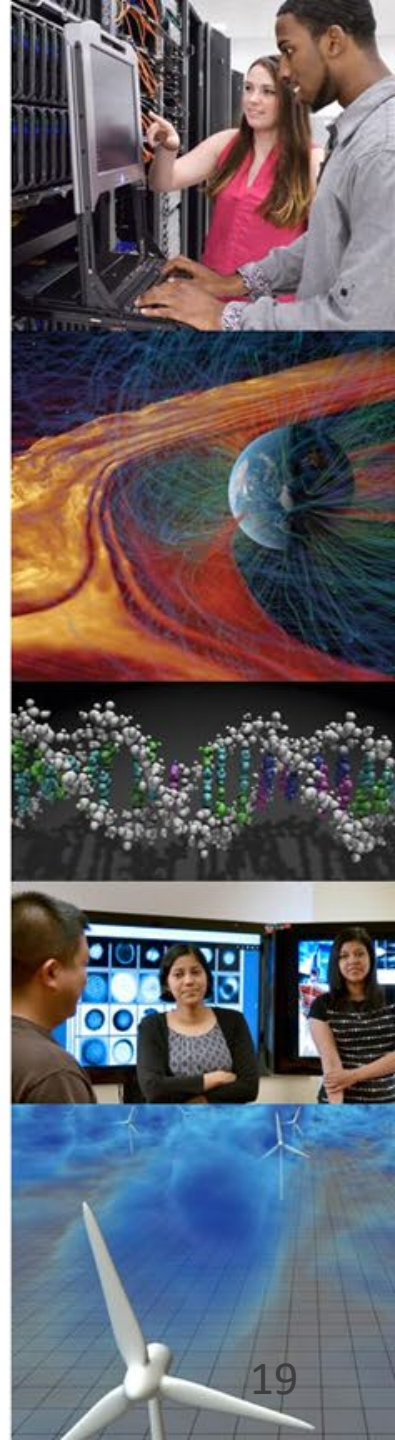


# Illinois Computes

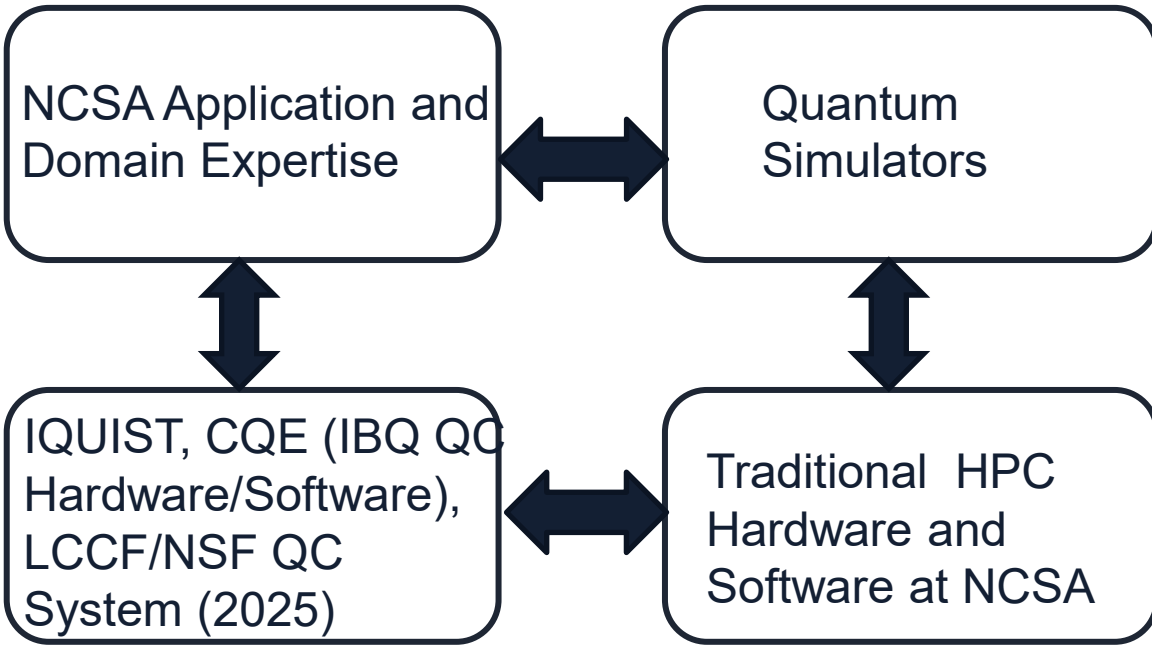
<https://www.ncsa.illinois.edu/about/illinois-computes/>

[PILOT PROGRAM FORM !\[\]\(c507f772dba2b921f86777f01218e570\_img.jpg\)](#)

You'll need an [NCSA Kerberos account](#) to log in and complete the form.



# The Dawn of Quantum Computing at NCSA



- Quantum computing as an emerging priority for NCSA
- NCSA's LCCF sub-award proposal is being reviewed (QPUs as accelerators to traditional HPC systems)
- QC Interest group at NCSA since last November
- Use Quantum Simulators for (self) training & education, development, and research
- Reformulating traditional algorithms to harness the full potential of QC

Promising candidates for Quantum Advantage:

- Quantum Chemistry / Material Science
- Quantum Machine Learning in Medical Data Analysis
- Quantum Extreme Scale Optimizations





# Summary

- NCSA is a state-of-the-art collaborative research facility
- NCSA is adapting through greater focus on applications and software, building on long history of incorporating innovation in our solutions
  - greater variety of systems specialized for different applications, needs
- NCSA's history also allows us to operate state-of-the-art and emerging resources that can be leveraged by our partners
- Partnerships are increasingly important
  - for cloud and hybrid cloud
  - for exotic compute capabilities including Quantum